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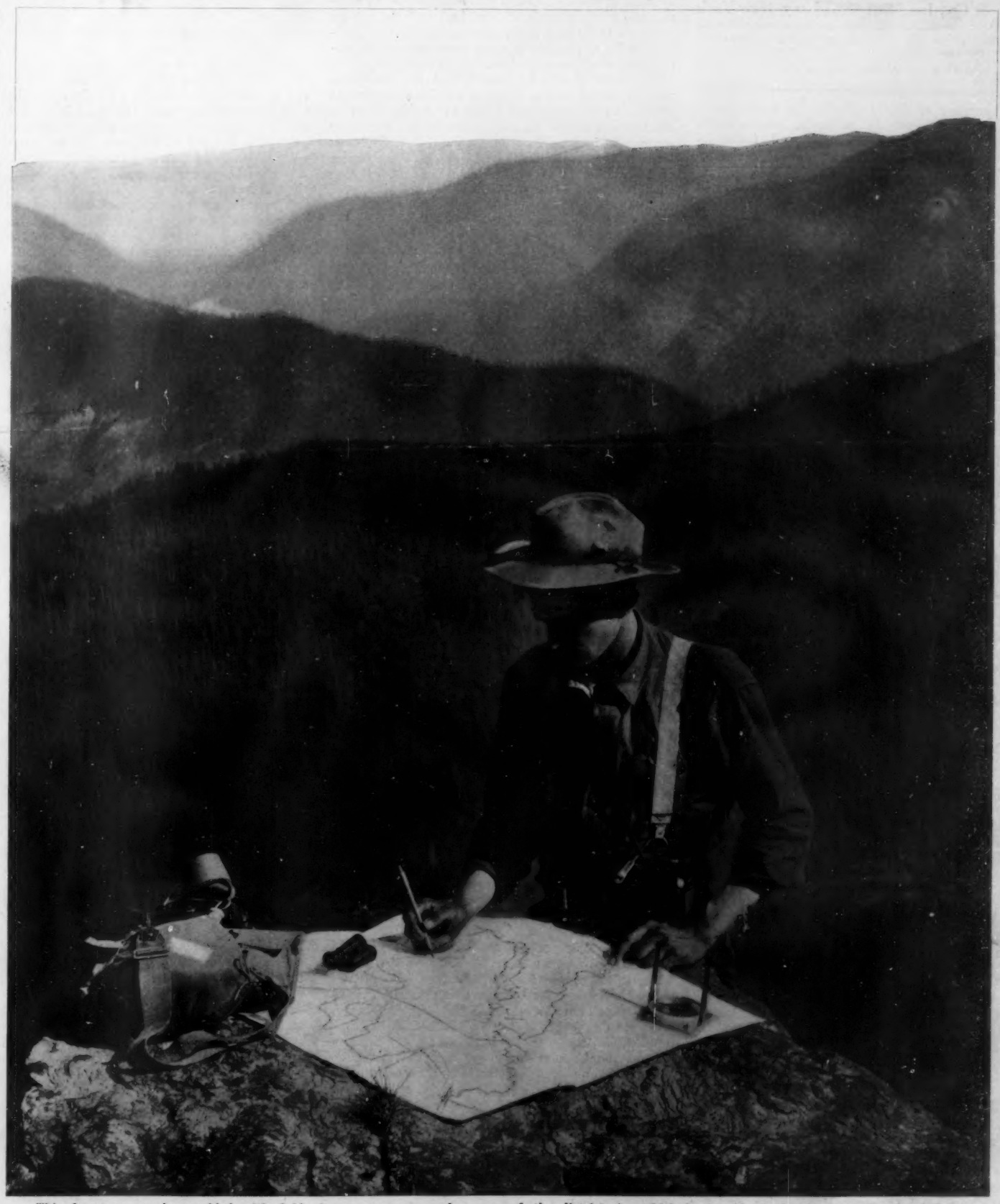

This forest ranger is provided with field glasses, compass, and a map of the district, by which he is able to locate an outbreak of fire.

FIRE PROTECTION IN THE ROCKY MOUNTAIN FORESTS.—[See page 48.]

SCIENTIFIC AMERICAN

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

"Holes in the Air"

IN view of the novelty of the art, it is surprising that what we might call the operative side of aviation should already have made such extraordinary advance. The principles of aviation were known long before the Wrights launched their first motor-driven machine from the earth, and questions of suitable construction were such as could be solved by any skilled and intelligent mechanic; but when the machine was once in the air, the would-be aviator was confronted by a vast and troubled ocean, the A B C of whose practical navigation he had yet to learn.

Although meteorological research had shown that the atmospheric strata lying nearer the surface of the earth are frequently in a state of confused unrest, it remained for the airman to determine just how perilous these conditions might be. Winds at or near the surface, which appeared to be blowing with great regularity, both as to direction and velocity, were found to be affected to an unsuspected degree by irregularities of the earth's surface —a mere ditch, a fence, or a low embankment serving to produce a break in the regularity of the flow of air above, which extended to a seemingly disproportionate height above the surface of the ground.

Apart, however, from irregularities of the air currents due to the configuration of the earth, the airman soon discovered that there were many other phenomena of atmospheric disturbance which it was not possible to attribute to the above-mentioned causes. The aviator, in his endeavor to explain them, has created quite a dictionary of his own, and the terms "holes in the air," "Swiss cheese," "boulders," etc., have already an accepted if not altogether correct meaning in aeronautical parlance. The most common causes of these phenomena are the ascending or descending currents of air. When an aeroplane enters a descending current, there is, of course, an immediate decrease of pressure, and therefore of sustaining effect, beneath the planes, and the machine drops. "Hole in the air" expresses not the actual condition, but the sensation as experienced by the aviator, who feels literally as though his machine had dropped into a hole. Conversely, when an aeroplane enters an ascending current, the increase of air pressure beneath the planes tends suddenly to lift the machine, with an effect of impact which is suggestive of the jolting caused by boulders or other obstructions to the progress of a land vehicle.

The letter of Prof. Elihu Thomson, which is published in our correspondence column, shows that the "hole in the air" or the "boulder" effect may result from other causes than vertical air currents. A "following gust" or a "slackening head wind," although their action is along horizontal instead of more or less vertical lines, may be equally confusing to the aviator, and perilous to the stability of his machine. We agree with Prof. Thomson that an increase in the speed of the wind, due to an overtaking gust, if it occurred in a period of time which was too short for the machine to accelerate, would render the control apparatus inoperative, and the aviator would be in great danger of a fall. These sudden changes in the velocity of the wind do occur, and, in the nature of things, must be impossible to foresee. The aviator, of course, will endeavor to retain control by a swift descent, in which he will try to gain sufficient velocity to restore his equilibrium under the new wind conditions; but if he should happen to be too near the earth, a disaster will be inevitable.

Prof. William J. Humphreys recently read at Washington a paper on this subject, in which he pointed out that the predicaments to which we have referred above may occur as the result of an aviator, in his descent to earth, passing suddenly from a stratum of wind moving at a certain speed in his direction, into one which is moving in the same direction, but considerably faster. Here also there will be a sudden loss of reaction beneath the planes and the same risk of fall. We believe that an unsuspectedly large percentage of the one hundred or more fatalities that have resulted from aeroplane accidents during the last three or four years, have been due to the conditions above referred to. Such changes in the air are generally impossible to foresee and provide against. The best that the aviator can do is to fly high and make his ascents and landings as far as possible in open spaces where the surrounding conditions are favorable to steady winds.

We think it will be agreed that the conditions pointed out by Profs. Thomson and Humphreys are probably answerable for many of the fatalities in aviation—or should we not rather say that the latter are due to ignorance of these conditions? And this leads to the conviction that the scope of the course of instruction in the so-called schools of aviation should include a study of meteorological laws, etc., and particularly of the vagaries of the air currents and the effect upon them of the configuration of the earth.

A pupil who has learned the art of flying upon an open field, chosen for its freedom from aerial disturbances, is, after all, but poorly equipped to undertake a cross-country flight. He should be first made familiar with the atmospheric conditions both as ascertained by meteorological observers at the various testing stations, and by the older and experienced aviators in their flights over country of widely varied topographical configuration. In this connection we suggest that the wonderful flight of Rodgers across the United States should yield a rich harvest of information upon this most vital subject.

A Government Laboratory for Manufacturers

TO those who read the article on "A Laboratory for Manufacturers," in the SCIENTIFIC AMERICAN of December 30th, in which was set forth in a general way the character of the work done by the remarkably organized and equipped Koenigliches Materialpruefungsamt of Berlin, the question has probably occurred: Why have we no such laboratory in the United States? Why is it not possible for the small American manufacturer to get the best expert advice in the improvement of his product?

The various Government bureaus unquestionably do much valuable technical work in behalf of American business men, work which in scientific and commercial value is equal to that done at Gross Lichterfelde. Thus we find that the United States Geological Survey may be freely consulted on the subject of coals, metals, building materials, and even the strength of bridge girders; the United States Department of Agriculture gives much valuable help not simply in the way of guiding the farmer in the selection of seed, the growing of crops, and the choice of farm equipment, but even in analyzing food products, in pointing out the utility of corn stalks for paper making, in indicating the manner in which such waste products as cotton seed may be industrially utilized; and the Bureau of Standards is beginning to broaden out so that its work includes not simply the testing of instruments of precision and the standardizing of weights and measures, but also the testing of paper and the like. Nowhere, however, is it possible for the American manufacturer to find a single laboratory devoted exclusively to his interests. There is too much clashing of the Government departments as they now stand, too much duplication of the same work. Why, for example, should the Geological Survey and the Bureau of Standards engage in substantially the same kind of research so far as steel girders are concerned? Why should the Department of Agriculture concern itself with pure foods and drugs?

The time has long since passed when a manufacturer's sole concern was to make a thing as cheaply as possible and to sell it as dearly as possible. The quality of the thing he sells, no matter how cheap it may be, is now of vital importance. The determination of that quality is a scientific task, a task, moreover, which means a knowledge of chemistry, microscopy, photography, engineering, or physics—in a word, the very kind of exact knowledge which a manufacturer is not expected to have. On the other hand, the maintenance of a staff of scientific men, capable of improving the quality of a manufactured product, may entail an expenditure of money out of all proportion to the magnitude of the business, except in the case of the largest industrial corporations. Unless the small manufacturer can turn to some central Government testing station, as the small German manufacturer is enabled to turn to Gross Lichterfelde, he is bound to be crushed by the huge corporation. He will be crushed, moreover, not by the power of millions, but by the power of scientific knowledge. He will never realize that a microscopist whose eye has been glued to a lens, and a chemist who pours the contents of two test tubes together, have put him out of the commercial race.

Whatever may be said against the huge aggregations of wealth which it is our present policy to attack, it cannot be contended that their products have been bad. Without exception they have maintained splendidly equipped laboratories for the sole purpose of improving their products. Our sugar is made scientifically, and is a better quality of sugar than our fathers bought. Our oil is refined by chemists and is a better oil than the oil refiner of a half century ago could produce. Our steel is made by processes which could have been developed scientifically only with the aid of millions. If we would complete the work of restoring free competition in trade between the great trusts and their smaller rivals, the Government must place at the command of that small rival a scientific equipment and scientific brains fully as good as those at the disposal of the great corporation. That end can be attained by the establishment of a Government testing station which shall perform for the American manufacturer, great or small, the same work which the establishment at Gross Lichterfelde performs for the German.

The need of such a laboratory is distinctly felt by any business man who has attempted to carry out the specifications of contracts which have been worded by their framers in entire ignorance of commercial conditions. Especially in such manufacturing, where raw materials must be adapted for a particular process, and where specialization has rendered necessary the use of a particular substance, whose qualities must be known beyond peradventure, is apparent the need of such a laboratory as we have in mind.

The Government itself requires the services of such a laboratory; for the Government is a large consumer of bridges and buildings, clothes and shoes, live stock and machinery, all of which are supplied after bids are received and contracts made. Justice to the taxpayer demands that the Government shall receive the best articles for its purpose at the lowest price. The various bidders who reply to Government tenders should be entitled to equitable treatment so far as their supplies are concerned, and equitable treatment can be obtained only by determining the scientific character of their supplies. A bid for X Y Z brand of flour means nothing scientifically. New York city until recently was wont to order "No. 1 white-clipped oats," quite ignorant of the fact that such oats had not reached the Metropolitan market in years. Without proper Governmental standardization many a city and many a firm will continue to order goods to which obsolete and inaccurate designations are given, with the result that the contract is never carried out in the proper way.

The determination of a bag of flour's suitability for a certain purpose depends on something more than a brief investigation by a purchasing agent, or on a rough analysis or two. It means a careful investigation of the material, and what is more, the conditions under which it is produced and used. Foodstuffs and textiles, the materials of construction and engineering, in fact, all articles that play a part in our daily lives, from lead pencils to bridges, from shoe buttons to hair dyes, should be made the subject of scientific examination to determine their fitness for specific uses, and to aid the manufacturer in their improvement.

Although the National Bureau of Standards has lately begun to assume these duties, it seems more qualified to carry on such purely scientific work as that of the Physikalische Reichsanstalt and might well leave the purely commercial application of science to a specially created laboratory. The Department of Commerce and Labor would seem to be the proper Government branch to undertake the standardization of commercial products for the manufacturer. That task it can perform only by establishing a laboratory with the equipment of the Koenigliches Materialpruefungsamt, a laboratory which would necessarily assume the duties which are now rather gratuitously carried on by the United States Geological Survey, the United States Department of Agriculture, and the Bureau of Standards.

Francis Bacon Crocker

An Educator Who is Also an Inventor Engineer

By Thomas Commerford Martin

ONE of the disadvantages of being able to do good team work is that the individual personality, so far as public appreciation goes, is often merged or submerged. There is a lot of individuality about Crocker, that is of the early New England puritanic type. When he gets excited a keen glitter comes into his eye which shows how gleefully he would once have sent an opponent to the stake, or how cheerfully he would have gone himself. And yet this man has done more for standardization electrically than any other living American, enlisting all the forces for a common object; and his name for years as a manufacturer of dynamos and motors has been hitched with that of some one else; either spelled out, or, according to a detestable practice, abbreviated into initials, like those of underwear or a brand of smoking pipes.

Born of eminently antique and respectable parentage, of a race that still lingers barnacle like around Barnstable, Mass.—and that evidently has a nice taste in prophetic family names—Dr. Crocker went to Columbia University, from which he graduated in 1882, and whose degree of Doctor of Physics he holds worthily, though he sets little store by it because it does not really represent his aims, his profession or his life work. At college he had the good fortune to fall in with two other young fellows, keen like himself for all things electrical, who talked to each other from home to home with juvenile telegraphs and built infringing telephones in innocent contempt of patents and courts. One of these was Charles G. Curtis, son of George Ticknor Curtis, and now known to fame as the inventor of the Curtis steam turbine. The other was Schuyler Skaats Wheeler, who since has been, like Croker, president of the American Institute of Electrical Engineers, and who has given the splendid Latimer Clark electrical library to his fellow members. They were a notable trio. On graduation, Crocker and Curtis jumped at once into building electric motors, small but good, depending chiefly on battery current, which they supplied from novel battery jars for all the world like crockery "growlers." It was the psychological moment of electric power development, and bigger and bigger motors were demanded. Then came the Crocker-Wheeler Company to make the larger apparatus from that day to this, with increasing range of applicability and acceptance. It was a hard fight, but no two college football players ever tackled harder or bucked the line more fiercely.

Leaving Wheeler to be the father of the modern fan motor, Crocker, always a bit pedagogic, turned his attention to education, and became the first teacher of electrical engineering for his alma mater. This was the real beginning of such studies in the United States. Under dear old Anthony at Cornell, there had been a grafting of electrical studies on physics; and Rowland did much the same thing at Johns Hopkins, sanctioned perhaps by the dictum of Lord Kelvin that an electrician was nine-tenths a mechanical engineer. Crocker treated such an educational theory with scorn. He started out to make and graduate electrical engineers, and he did, while every college has followed pretty much his lines ever since. It was bold and revolutionary thus to insist that a real new profession had come on the earth, but Seth Low and Columbia gave Crocker a free hand in proving the case, and electrical engineering is eternally his grateful debtor. It took a good deal of sane fanaticism to win out, but nobody to-day questions for one moment the fact that an electrical engineer is distinct and different from every other engineer and must be treated with corresponding respect. The old superstition of his fractional devisibility has gone forever, thanks to Dr. Crocker.

What worried Crocker most in those early days of electrical invention was the absence of standards, when everybody's lamp or motor was better than any other, with a percentage of efficiency never below 110 per cent. This provoked to indignation a man who would tell the truth even if he had to be rude about it, and so the young professor started out on a new crusade, that of electrical standardization, than which a higher mission in mechanics was never undertaken. We are struggling in vain to rectify and harmonize the units of the past; Crocker made up his mind that the units of the future should be common, universal and undeviating. It is true that once in discussion, with the spirit of '76, he declaimed in favor of a good plain "North American volt," but all he meant was a volt that would be recognized by all the scientific courts of Europe. It would be hard to define all his work in the cause of standardization, but the records show his powerful guiding hand in the shaping of the National Electrical Code, the authority to-day for all construction work in the country. Not less in importance was his work as chairman of the committee which fixed for the American Institute of Electrical Engineers its standardization rules for electrical apparatus, carried through ten years later in 1907. This was a great piece of work, whose merit grows from year to year. Dr. Crocker has served also as an active member of the important International Electrotechnical Commission. Best of all to some of us was his successful fight to secure the adoption of "henry" as the universal name for the unit of self induction, instead of the footling "quadrant" and "secolun" adopted by the Electrical Congress in Paris. An ardent admirer of his prototype, Joseph Henry, who was discoverer independently of the phenomena of self induction, Dr. Crocker gratified hugely his own intense Americanism by thus securing for this country a personal name for an international unit, kindred to those designating the watt (English), the volt (Italian), the ohm (German), and the ampere (French). Incidentally it may be noted that Prof. Crocker was chairman in 1889 of the A. I. E. E. committee which fixed the standard resistance of copper, accepted without question throughout the United States. Dr. Crocker has also served two years as president of the New York Electrical Society—the oldest body of its kind in this country.

Another side of Dr. Crocker's work has been that of authorship. Probably not far short of 100,000 copies of his books have been sold. This is not a large figure in the list of "shilling shockers" and "best sellers," but in technical literature means distinct success and vogue. These books have dealt with the "diseases" of motors, the management of electric machinery, electric lighting, etc. It is illustrative of the broadness of the man that some of his best writing was done for a correspondence school. He is no Brahmin, but if he finds a man anxious to learn, is at once anxious to teach. Some who can instruct classes cannot for their souls get it in good shape on paper. Others can write like angels, but their teaching would not move the mountains of ignorance they so often find in front of them. Crocker is a good all-around exponent of things; and when he has a new fact or a view on any subject he hates to suppress it in silence. If he could get down to it, probably no man is better qualified than he to do some general magazine work along the line of popular instruction in electricity. This is badly needed, after the deluge of flubdub of a distinctly yellow character that has left the public most accurately misinformed as to what electricity is not. Woodrow Wilson is not the only university man in demand outside the quadrangle.

There are other things Crocker has done, one of which was to act for President Roosevelt in 1906 as member of an Advisory Board on Fuels and Structural Materials, which standardized specifications, methods of testing, etc.; but enough has been said, may be, to outline the man and his career. The idle moments of this busy life have been spent chiefly in travel. The Doctor had an invitation to breakfast on the American fleet at Manila, but did not keep the engagement, for bombardment of the insurgents began while he was hiring a boat to go aboard. He is distinctly popular in Japan, and students there with his earmark lie in wait to do him honor every Sabbatical year.

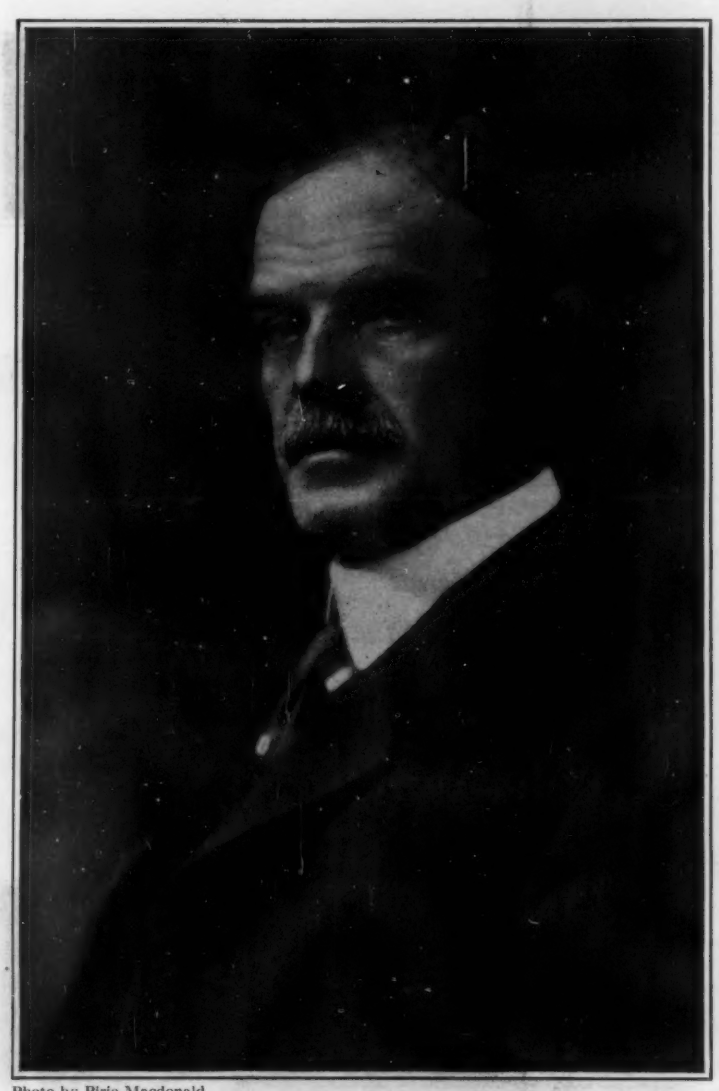


Photo by Pirie Macdonald.

FRANCIS BACON CROCKER

The Eskimos of Victoria Land

ISOLATED communities of human beings are so few in this day of rapid travel that a special interest attaches to the letters received from time to time at the American Museum of Natural History from Mr. V. Stefánsson, who, accompanied by Dr. Anderson, is visiting the Eskimo settlements about Coronation Gulf and Victoria Land, on the north coast of British North America. Two Eskimo villages were discovered in the middle of Coronation Gulf, each containing about 80 inhabitants. With the exception of one man who had visited Dismal Lake no person in the villages had ever seen a white man. The grandfathers of two of the natives had seen white men or Indians at one time on the lower Coppermine River. Incidentally this expedition has gleaned a great deal of geographical information. Thus it was found that there are at least three or four times as many islands in Coronation Gulf as shown on the charts.

An Earthquake in Central Europe

A SEVERE earthquake, causing considerable damage to property, but, so far as known, no loss of life, was felt throughout Württemberg, Bavaria and Switzerland, and over large parts of France and Italy, on November 16th, about 9:25 P. M. The epicenter is believed to have been not far from Donaueschingen, in southern Germany.

The "Cement Gun"

Plaster Work Done With a Hose

By Ralph C. Davison

C. F. AKELEY, the taxidermist and naturalist connected with the Field Columbian Museum of Chicago, was hunting about for a rapid and economical method of building up forms over which the skins of large mammals, such as elephants and hippopotami, might be stretched, when he hit upon the idea of spraying rough frames with Portland cement. The scheme worked perfectly.

When the exterior of the art gallery (one of the World's Fair buildings in Chicago) needed renovating, it occurred to Akeley that his spraying system might be used. The work was done under his direction so well and expeditiously as to demonstrate the practical possibilities of the new method beyond any question of doubt. After this most successful experiment the apparatus was taken up in the laboratory and in the field, and was subjected to various practical tests. Numerous mechanical changes were made as were shown necessary by experiment, adding to the efficiency of the apparatus and broadening its field of usefulness, until to-day the "cement gun," as the apparatus has been named, is being used for placing cement in some of the most important engineering work that is now in course of construction. Of course the machine is not a gun in the ordinary sense of the word, but is so called from the fact that the cement mixture is projected from a nozzle with considerable force, and is literally "shot" into place.

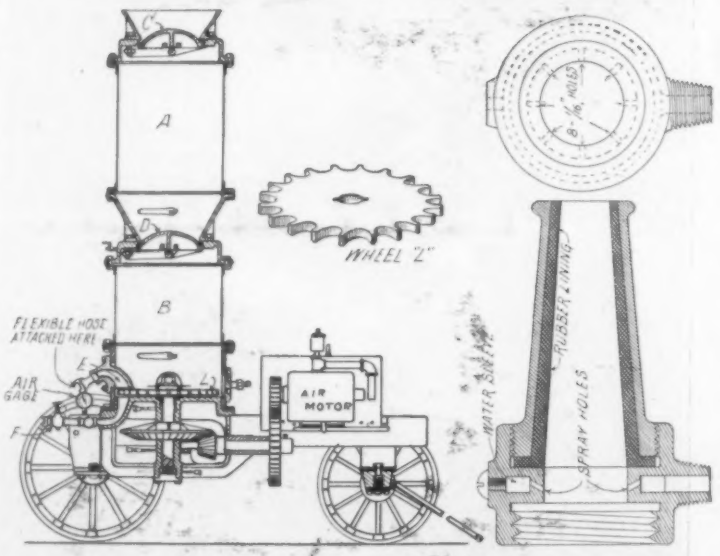
The accompanying drawing shows a cross section of the gun as it is now made. It consists essentially of two vertically superimposed cylindrical chambers *A* and *B*. Admission to the upper chamber is had through the swinging gate valve *C* working against a rubber gasket. Chamber *B* is separated from chamber *A* by another and similar gate valve *D*. Both the upper and the lower chambers are provided with hand-operated agitators. These are used to break up any lumps which might develop in the dry mixture of cement and sand.

The discharge apparatus is an interesting feature of the machine. It is located at the bottom of the lower chamber and consists of a heavy iron feed-wheel *L*. This is an inch or more in thickness and is provided with a deeply serrated or socketed edge, forming pockets which carry the material in intermittent charges into the stream of air. Over the edge of this feed-wheel is curved the blow-pipe *E*. The air supply to this pipe is controlled by the valve *F*. Air admitted through this valve throws the cement mixture upward and out through the goose-neck, shown above the air gage, into a flexible hose to the end of which is attached a nozzle, the detail of which will be explained farther on.

The operation of the machine is as follows: First, the lower chamber is charged with a dry mixture of cement and sand. The valve *D* is then closed and the upper chamber *A* is charged with a like mixture. The operator then closes the valve *C* and by opening a valve admits compressed air into the upper chamber until the air pressure in both chambers is equalized. Now the valve *D*, which is held closed by the air pressure in the lower cylinder, drops down under the weight of the charge of dry mix in the upper cylinder. This mix then enters the lower cylinder, the valve *D* is closed and the air in the upper cylinder is exhausted. The valve *D* is locked by the pressure from below and the valve *C* drops open automatically by its own weight and the gun is ready for another load of cement and sand.

It will be seen from the above that the air in the upper chamber has no function whatever in the operation of the machine except to hold the swing valve in place. The upper chamber is analogous to a caisson lock, thus by its use a constant pressure is maintained in the lower chamber which allows a uniform pressure to be maintained in the discharge pipe.

Sealing rock with gunite to stop disintegration at Panama.



Sectional view of the "gun" and details of the nozzle and feed-wheel.

The cement gun in use.

Note the double hose, one for water and the other for sand and cement.

As the feed-wheel revolves, it carries in its pockets but a small portion of the mixture at a time into the air current. The curved pipe, which is shown coming down upon the feed-wheel, is hooded so that the air pressure drives the cement mix directly into the outlet pipe on the other side of the feed-wheel. This feed-wheel or plate is revolved by a small air motor direct-connected to it by means of gearing. The output of the machine depends directly upon the speed at which this plate revolves. Therefore the volume of the stream can be changed at will by simply regulating the air supply to the small motor. To stop the discharge the air supply to the small motor is cut off.

The nozzle through which the cement mixture is delivered to the work is of particular interest, an illustration of it is shown herewith. The dry sand and cement mix is delivered to this nozzle through a flexible hose, and the water is added to it in the form of a fine spray produced by a ring of centripetal jets. The water is forced through eight 1/16-inch spray holes leading from a water sleeve, which completely surrounds the larger end of the nozzle as shown. The feed of dry mix, as before stated, is controlled directly from the machine. The water supply, however, is delivered through a separate ½-inch hose line under ordinary city pressure. Considerable trouble was experienced with the rapid wearing out of these brass nozzles due to the abrasive action of the cement and sand. After considerable experimenting it was found that rubber withstood this abrasive action better than any other substance; therefore a special rubber lining is now provided with each nozzle.

The product of the cement gun is called "gunite." This term has been applied to it so as to distinguish it from the ordinary hand applied stucco. There is a marked difference between cement stucco, which is applied by hand, and gunite. The latter is shot under a pressure of approximately 40 pounds to the square inch, and leaves the nozzle at a velocity of 300 feet per second (200 miles per hour). Thus the product is far denser, and of a much greater tensile strength than hand applied stucco. A striking illustration of the superiority of machine product over the hand product is that one ton of cement mortar applied by hand will cover 25 square yards of surface one inch thick, whereas one ton of cement mortar applied by the cement gun will cover only 16½ square yards, one inch thick. Evidently the machine stucco must be considerably more dense or compact than that applied by hand.

Another feature in favor of the former is that the combining of the cement and the water, necessary to produce the plastic material, takes place in transit, and they are not disturbed until placed. It is a well known chemical fact that the instant water is brought into contact with cement the initial set, or chemical combination, begins. The initial set must be looked upon as the commencement of that hardening which gives the final strength to the mass. Hence any subsequent manipulation or handling tends to disturb this initial set, and consequently must weaken the product. This objectionable handling is entirely overcome by the "cement gun" process; as just stated

the hydration takes place in transit and immediately before and during the placing of the mortar; the chemical combination takes place where it should, that is, in the final resting place of the mortar and not on the mixing board.

Comparative tests of mortars made by hand and by the cement gun have just been completed by a large and well known engineering company. These show that the product of the cement gun developed from 20 per cent to 260 per cent greater tensile strength and from 20 per cent to 72 per cent greater compressive strength than the product of the same mixtures of cement when made by hand methods. These tests also showed that compared with the most carefully prepared hand made cement, gunite is far more impervious and water proof, and that its adhesive qualities are on an average of 27 per cent better than those of hand-made work. There is apparently no limit to the field for the practical use of the cement gun as foundation work. Coating of steel to prevent corrosion, cement stone and cinder fill for floors, walls of buildings, cement stucco, building of fences, side walls and the covering of old wooden buildings have all been done with this process. The accompanying half tone illustrations show the method of applying cement with the cement gun as well as the results obtained.

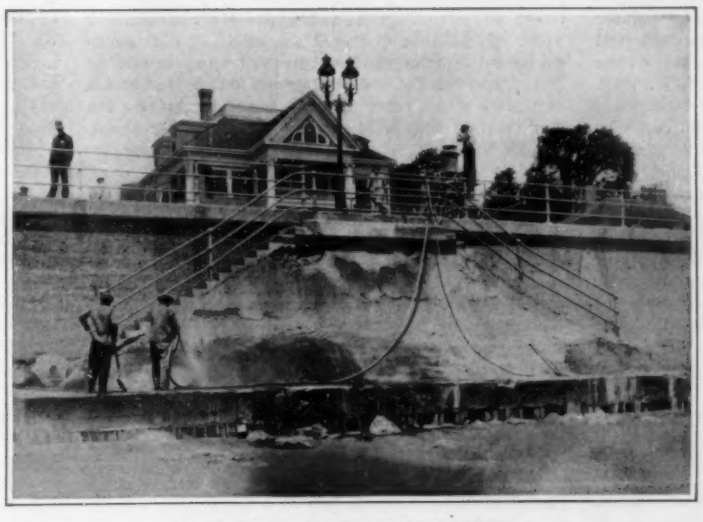
The method of coating a frame building is first to attach to it a woven wire mesh. The cement mortar is then shot on the surface thus prepared until it is of the desired thickness. At first the large and coarse grains of sand rebound until a thin layer or film of pure cement is obtained. Thus is produced a plastic base into which the coarser sand particles become imbedded and upon which the stream of mortar is played until the desired thickness of cement is obtained. The rapidity with which the work can be done is surprising. With but one nozzle in play as much as 60 square yards one inch thick per hour has been applied.

Hollow walls for buildings are made by erecting a frame work of 2 by 4-inch stuff and covering it on both sides with tar paper. Over the tar paper chicken wire is attached, and the cement mixture is then shot upon this surface as described above. Comparatively thin walls can be built up in this way as the wire is completely imbedded in the mortar and acts as a reinforcing. Side walks are also made with this process. The method used is to dig a trench and to fill it with the stone or cinder aggregate. Into this aggregate is then shot the cement mortar which completely fills up all the voids and produces a sidewalk of remarkable hardness and density.

Some of the work done on the Culebra Cut is also illustrated herewith. In the cut through Contractors Hill on the Panama Canal the rock encountered was of the nature of a fine grained clay. This was moderately hard when first exposed, but was found to crumble rapidly when subjected to the action of the air. To prevent it from disintegration the cement gun is being used to coat the surface with a belt of cement about 20 feet high, 10 feet above and 10 feet below water level. The general practice is to coat the bad rock with about 4 inches of material while good rock requires an inch, more or less. The rough contour of the rock is followed with no attempt at finished work.

Another illustration shows the sea wall at Lynn, Mass. This wall is 1,200 feet long by 12 feet high and, as shown, it had become badly disintegrated by the action of the sea water. The entire wall was repaired with a facing of "gunite," and it is now in a better condition than ever before.

Renovating a concrete wall that has been disintegrated by the weather.



Repairing a sea wall at Lynn, Mass.

Frame house before treatment with the cement gun.

The same house after receiving a coat of gunite.

The Antarctic Expeditions

R. C. MOSSMAN, of the Argentine Meteorological Office, sends to the *Scottish Geographical Magazine* the latest information so far published of the German and Norwegian antarctic expeditions. Lieut. Filchner's ship, the "Deutschland," left Buenos Aires October 4th, after a stay of four weeks, during which the magnetic and meteorological instruments were compared with standards. The ship is equipped with wireless and is to receive twice-daily time signals from the meteorological and magnetic station at New Year's Island (latitude 54 degrees 9 minutes south, longitude 64 degrees 8 minutes west). Information will also be regularly sent of the barometric pressure, temperature and wind force and direction at 8 A. M. and 8 P. M., Cordoba time. The power of the Marconi station at New Year's Island is to be greatly increased; but while the "Deutschland" will be able to receive she will not be able to send messages beyond a radius of 620 miles. Thus a one-sided conversation is to be kept up with the expedition—the first event of its kind in the history of polar exploration.

The ship was to carry out a series of soundings and other oceanographic work until November 10th, when she was expected to reach Grytviken, the headquarters of the Argentine Fishing Company on the north side of South Georgia, the main base of the expedition. Here a quantity of coal, and stores and thirteen ponies were to be embarked, and it was expected to start poleward December 1st, going due south in the meridian of 36 degrees west, and establishing a southern base in as high a latitude as possible to the southwest of Coats Land. The three motor sledges were tested in Buenos Aires and found unsatisfactory, and have been returned to the makers.

Amundsen's ship, the "Fram," which had proceeded to Buenos Aires after leaving the Norwegian explorer at the Bay of Whales, is now returning to the latter point, having left Buenos Aires October 5th. Instead of taking the short route around Cape Horn, in the teeth of the westerly winds, she is following the longer, but safer course south of Africa and Tasmania, under sail. It will be remembered that Amundsen's antarctic venture came as a great surprise to the world, and there is still a disposition to keep his plans under cover; the crew of the "Fram," while in Buenos Aires, were quite reticent on the subject. It is understood, however, that he was to leave for the south not later than the middle of last September, and that he hoped to reach the plateau by another way than that of the Beardmore glacier. Mr. Mossman believes that if the party can take sufficient food up the glacier to the plateau a trans-antarctic journey will be undertaken, in spite of official denials of such an intention. In this case the most likely place of emergence would be Alexander Land, a region previously visited by Amundsen in the "Belgica."

From other sources we learn that the Australian antarctic expedition, under Dr. Mawson, expected to leave in the ship "Aurora" for Wilkes Land about November 27th. The funds raised for this expedition, up to November 1st, amounted to $215,000. It is hoped to land three parties between Cape Adare and the Gaussberg.

The "Terra Nova," the vessel of Capt. Scott's British expedition, was badly damaged by stormy weather after leaving New Zealand in November, 1910. The necessary repairs and the cost of replacing lost stores have seriously depleted the resources of the expedition, and great efforts have been making in England to raise an additional fund of $75,000 to provide means of continuing the work of the explorers for another year.

The Japanese expedition, under Lieut. Shirase, was most unsuccessful last spring in its attempt to reach the antarctic continent, with a view to a dash to the pole. All its dogs were lost, and the party had to retreat to Australia. Now a second start has been made, with a larger company and better equipment.

Thus there are, at this writing, five well-organized expeditions engaged in the siege of the south pole. We may expect any day to hear that the goal has been attained by one of them.

The Geological Society of America

The Twenty-fourth Annual Meeting Described

By Edmund Otis Hovey

THE twenty-fourth annual meeting of the Geological Society of America was held at the new National Museum at Washington, D. C., from Wednesday to Saturday, inclusive, of Christmas week, and was the largest in the history of the organization. Prof. William Morris Davis, president for the year, presided, having made a special trip for the purpose to America from Paris, where he is serving as Harvard exchange professor of the Sorbonne. The first session of the society was occupied with matters of business. The secretary reported the election of twenty-nine new fellows, making the present active membership of the society 351.

During the past year there were lost by death Samuel Calvin, for many years State Geologist of Iowa; Samuel F. Emmons, a noted mining engineer who was connected with the United States Geological Survey from its organization, and was a member of the National Academy of Science; Christopher W. Hall, professor of geology at the University of Minnesota; Edwin E. Howell of Washington, D. C., and Amos O. Osborn of Waterville, N. Y. One foreign correspondent, Prof. A. Michel-Lévy, a famous French geologist, died. An indication of the activity of the society was the publication during the year of a volume of its "Bulletin" consisting of 738 pages of text and 31 plates, and including part of the papers read at the last preceding annual meeting, which was held at Pittsburgh a year ago. A large part of the volume was devoted to E. O. Ulrich's epoch-making contribution, "A Revision of the Paleozoic Systems."

About sixty papers were offered for reading at the Washington meeting, aside from those on purely paleontological topics. The latter were about forty in number and were read in the sessions of the Paleontological Society, which meets as a section of the Geological Society. A distinct effort was made this year to have the papers read in the general society, broad in scope, avoiding topics of merely local interest. This rather shortened the official programme, but it secured a good selection of topics for presentation and left some time for that active discussion which is always an important feature of a scientific convention. In spite of all restrictions, or perhaps on account of them, the range of matters brought forward was broad. Personal studies in Alaska, the Upper Yukon country, British Columbia, Central and Eastern Canada, Hawaii, the United States proper from the Pacific coast to the Atlantic, and East Africa gave opportunity for many interesting observations and much suggestive deduction.

It is not practicable in the limited space at command to give a full account of the papers that were read or even a list of their titles, and only a few of those of the most general interest can be mentioned. The annual presidential address by Prof. Davis was upon "The Relations of Geography to Geology." Inasmuch as the scientific treatment of geography and the consequent broadening of the science in America have been due to the initiative of this author during the past twenty-five years, the address was listened to with the greatest attention. The author showed the overlapping of the two sciences in many respects, contending that geography concerns itself only with the existing surface of the earth, whereas geology among other things treats of the surface of the earth at each of many past epochs —it is in part the geography of past ages.

Prof. J. Volney Lewis of Rutgers College gave a paper that detailed considerations of particular interest to mineralogists and geologists around New York. The author discussed the origin of the beautiful secondary minerals found in the trap rocks of New Jersey and concludes that they are due to the action of waters which come up with the rising lavas. Dr. George H. Ashley of Nashville, Tenn., in "A Stratigraphic Study of the Appalachian and Central States with Reference to the Occurrence of Oil and Gas," showed the incorrectness of the generally accepted view held by oil and gas men that the Appalachian region from Pennsylvania to Alabama was a stratigraphic unit and thus explained away in large part the mystery of the smaller yield of oil in eastern Kentucky, Tennessee and Alabama than in Pennsylvania and West Virginia. The diamond-bearing area of Arkansas has recently been examined by Prof. L. C. Glenn of Nashville, Tenn., and found not to be as extensive as has been supposed. Evidence, too, was discovered of the circulation of heated waters about the margin of the original pipe of peridotite ("blue-rock") described by J. C. Branner.

As usual, many papers were offered dealing with glacial phenomena, both recent and ancient, ranging from the existing glaciers of Alaska to those of the Glacial Epoch that once covered New York State. The wide observations and studies of Prof. B. Shimek lead him to the conclusion that the term "loess" should be used only in a lithological sense, since deposits of this character occur at different geological horizons. Prof. George L. Collie of Beloit, Wis., described the British East African plateau, showing that four physiographic regions may be recognized, as follows: The coastal plain, the foot plateau, the gneiss plateau and the lava plateau. The last includes within its boundaries the great Rift valley.

An interesting discussion was that introduced by two papers upon the stability of the Atlantic coast, one of which was by Prof. D. W. Johnson of Cambridge, Mass., and the other by Dr. Charles A. Davis of the United States Geological Survey. Prof. Johnson gave other explanations for the phenomena that have been held to indicate recent subsidence and stated as the result of much study the conclusions that the land along the Atlantic coast can not have subsided as much as a foot within the last century; that there can have been no long-continued progressive subsidence at as high a rate as one foot per century within the last few thousand years, and that no evidence thus far available can be regarded as satisfactory proof of any degree of recent subsidence either spasmodic or progressive. Dr. Davis' work on the peat marshes along the coast has led him to somewhat different conclusions.

The largest audience of the meeting was that which gathered to listen to the symposium on the "Occurrence of Delta Deposits in Geological Formations." This was opened by Prof. J. Barrell of New Haven, Conn., with a paper on the criteria for the recognition of such deposits. The subject is found to be so complicated that the author reaches two chief conclusions: First, the need of extended study of the stratigraphic characters of present sedimentation; second, most individual criteria are to some degree indeterminate, and a conclusion in regard to the mode of origin of a formation or a part of a formation should, in order to obtain acceptance, be based on the convergence of several lines of evidence. This paper was followed by one by Prof. A. W. Grabau of New York city, who adduced illustrations of ancient delta deposits from the Shawangunk Mountains and elsewhere, and by Prof. E. B. Branson of Columbia, Mo., who described a Devonian-Carboniferous delta in the northern New River district of Virginia.

Wednesday evening the Geological Society of America joined with other affiliated societies and the general American Association for the Advancement of Science in listening to the address of welcome by President Taft. Thursday afternoon was devoted to visiting the Geophysical Laboratory of the Carnegie Institution, while the evening was occupied with the annual dinner of the society followed by much speech making under the graceful leadership of Dr. J. M. Clarke of Albany, N. Y. On Friday evening, the presidential address of Prof. Davis was followed by a smoker at the Cosmos Club tendered by the Geological Society of Washington to the Geological Society of America, the Paleontological Society and the Association of American Geographers. The officers elected for 1912 are: President, Herman L. Fairchild; vice-presidents, I. C. White and David White; secretary, E. O. Hovey; treasurer, William Bullock Clark; editor, Joseph Stanley-Brown; librarian, H. P. Cushing. The next meeting of the society will be held at New Haven, Conn., a year hence.

An Appreciation from Connecticut

IN its special naval edition (issued the 9th inst.) the SCIENTIFIC AMERICAN has shown what it can do when it tries. The illustrations—they first strike the eye—are remarkable for number and quality. Among the contributors are the President of the United States, the secretary of the navy, and four rear-admirals. Editor J Bernard Walker's own contribution—"A Landsman's Log aboard the Battleship North Dakota"—adds to the value, as well as the readableness of the number.

The President's brief autograph letter is printed in *fac simile*. "Until peaceful means of settling all international controversies are assured to the world," wrote William Howard Taft, "prudence and patriotism demand that the United States maintain a navy commensurate with its wealth and dignity." From Secretary Meyer's article on the business management of the navy we make two extracts:

When the Panama Canal opens, and the fleet spends probably an equal amount of time in each ocean, the work for the Atlantic yards will be much reduced and it will be even more evident that fewer will be needed. By a proper reduction in navy yards, there would be a vast saving of money in maintenance, probably three to four millions a year, and a realization of funds from the sale of real estate. If this is not done, Congress must assume the responsibility. . . . The aim of this administration has been to introduce into the management of the navy, modern efficient business methods, to reduce correspondence and cut out red tape. Economies have been established and output increased. Nor has the department, in its efforts to reduce expenses, forgotten the paramount importance of the highest military efficiency and a preparedness for any emergency. To-day, when needed, it holds to preserve the peace a larger and more efficient fleet at a smaller cost of upkeep. The changes in organization have justified themselves by results and are paying—the final test of all business management.

In preparing and publishing this special edition the SCIENTIFIC AMERICAN has not only covered itself with credit but rendered a valuable and double service—to the public on the one hand and to the navy on the other. Our hearty congratulations.—*Hartford Daily Courant*, Tuesday, December 26th, 1911.

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Statistics of Smoke and Soot in the Air

WE learn through *Prometheus* the results of a unique investigation undertaken at the instance of Prof. E. von Esmarch, whose complete report on this subject is published in *Rauch und Staub*.

During the year 1910, under Prof. von Esmarch's direction, measurements were made of the degree to which the air of thirty cities in Austria and Germany was contaminated with smoke and soot. Observations were made three times a day, viz., at 8 A. M., 12 noon, and 6 P. M. At each observation a uniform volume of air was drawn rapidly through a paper filter by means of some form of aspirator. According to the amount of smoke and soot in the air the paper was more or less darkly tinged at the end of the observation. Its color was compared with a scale of six numbered shades, copies of which were furnished to all the collaborators, and the filter was marked with the number of the shade to which it most nearly approached. Finally the filters for a whole month, at each station, were collated; their numbers being added and divided by the total number of observations, and the result being set down as representing the smokiness and sootiness of the air for the place and period in question. The results, while giving no indication of the absolute amount of smoke and soot present, furnish a useful means of comparing the purity of the air in the different cities. The contamination of the air by factories, in the large industrial centers, is made evident by the table published in connection with Prof. von Esmarch's paper; but there is also a very surprising effect due to the fires of dwelling houses, especially in winter.

Engineering

To Bridge the Straits of Shimonoseki.—The Railway Bureau of the Japanese government is planning to build a railway suspension bridge over the Straits of Shimonoseki, at an estimated cost of $7,500,000. The bridge is to connect the towns of Moji and Dannoura, the width of the waterway here being only 1,000 yards. We are not able to state whether the bridge material will be manufactured in Japan; though it would be characteristic of the race to carry through the whole project, from raw material to finished structure, entirely in Japanese shops and by Japanese labor.

Testing Concrete Ties.—The Pennsylvania Railroad Company is making a test, on a spur of its line in West Philadelphia, of a form of concrete tie. The rail rests in a pocket formed in the enlarged ends of the tie. The track presents a very neat and substantial appearance, and if the problems arising from contraction and expansion resulting from changes of temperature can be successfully overcome, the tie should represent an ultimate economy of considerable magnitude, particularly in view of the ever increasing price of timber ties.

Ambrose Channel Ninety-three Per Cent Complete.—For a width of 1,200 feet the Ambrose Channel now has a depth of 40 feet at mean low water, for over 3½ miles of its length, and it has the same depth for a width of 1,800 to 1,900 feet over its other 3½ miles of length. The rest of the full width of 2,000 feet is from 35 to 40 feet deep. At mean low tide, this fine channel into New York Harbor is navigable by ships of 37 feet draft. Its maximum high water capacity is 44 feet.

New Haven Railroad Electric Zone to Be Extended.—Evidently the directors of the New Haven Railroad Company are satisfied with the electric operation of their trains between Stamford and New York, a stretch of 34 miles; for they have announced that the system is to be extended from Stamford to New Haven, a distance of 41 miles. It speaks well for the present installation that the new equipment will be practically identical with that on the existing electric road. The estimated cost of the work is about four million dollars.

One-thousand-foot Ship is Ordered.—We are informed by a high official of the White Star Company that an order has been definitely placed with Harland & Wolff, Belfast, for the construction of a ship of the "Adriatic" type, which will be one thousand feet in length. The vessel will be driven at 18 knots by a combination of reciprocating engines and turbines. She will have a ratio of beam to length of one to ten, and therefore her breadth will be 100 feet. If the ship sails to this port she must dock at South Brooklyn, where alone are piers of sufficient length to accommodate her.

Subway Cars Without End Doors.—The Brooklyn Rapid Transit Company has planned a new type of subway car designed for larger seating capacity and a more speedy loading and unloading of passengers. End doors are abolished and passengers will leave through three pairs of side doors, evenly spaced along each side of the car. The seating capacity will be 70, as against 42 for the present subway cars. In the non-rush hours, by closing some of the doors, the seating capacity can be raised to 84. Estimated on the standing capacity of the present subway cars, the new design will carry 102 persons standing, or a total of about 175 persons per car.

Important New Railway in Uganda.—The town of Jinja lies on the north shore of Victoria Nyanza. It is found on only the newest maps. Those of a few years ago showed "Ripon Falls" at nearly the same location. Just north of Victoria Nyanza lies a chain of lakes, the most important of which is Lake Kioga (also spelled on official maps "Choga"). A railway from Jinja to Lake Kioga is now rapidly approaching completion. A glance at a recent map of Africa will show that the new line is to form an important link in the chain of rail and water communication between Mombasa and Cairo. Steel ties are used throughout in the construction of this railway, of which 16 miles have been completed.

African Railway Projects.—Five vast railway projects for the opening up of Africa are at present either in progress or seriously considered. First, there is the great Cape to Cairo Railway, whose northern and southern sections are pushing slowly to an ultimate junction in mid-Africa. Then there is the French Trans-Saharan, and the further scheme of that nation to join the valley of the Niger and Lake Tschad with the Atlantic coast by means of the Trans-Soudanese Railway. Germany also has planned the Trans-Equatorial road, her first important railroad development in Africa. The fifth enterprise contemplates building a line from the Straits of Gibraltar southerly along the Atlantic coast by way of Casablanca and Agadir to Dakar, which is an important point of shipment for west Africa, where France has lately built an important naval station.

Electricity

A Trans-continental Telephone.—President Vail, of the American Telephone and Telegraph Co., has announced that a through telephone service between Los Angeles and New York will probably be established by the first of next November. The cost of the line will be half a million dollars, and the tolls per conversation will run between $14 and $15.

Telephoning from England to Switzerland.—The American consul at Birmingham reports that the completion of a new submarine cable between England and France has resulted in the successful telephonic transmission of messages between Great Britain and Switzerland. Satisfactory commercial conversations are now carried on between England and Geneva, via Paris and Lyons, and with Basel, via Paris and Belfort.

Lightning and Telephone Wires.—A careful analysis of Prussian lightning statistics, by K. Langbeck, shows that damage due to lightning has markedly decreased in the cities in recent years. This decrease is attributed to the great extension of overhead telephone wires; and it is anticipated that the recent general change to underground conduits will lead to an increase in lightning damage.

Ozonized Air for London Tubes.—According to a consular report, the Central London Railway Co. is installing a ventilating system designed to supply 80,000,000 cubic feet of ozonized air in the stations of its tunnel system. One of the plants has already been completed and is supplying 400,000 cubic feet per hour. This is estimated at 900 cubic feet per person each hour, as against 300 cubic feet, which is the usual allowance in buildings. The air is ozonized by passing it over electrified plates, after which it is driven by means of fans to the station and distributed thereabout through ducts.

Calorized Electric Soldering Iron.—An electric soldering iron possesses an advantage over the ordinary soldering iron in the fact that it can be kept hot continuously. However, there is a fault common to both types of soldering iron, namely, that the copper wastes away rapidly and must be frequently renewed. Recently a method has been discovered of mitigating this fault. It consists of treating the copper to make it non-oxidizable under high heat and non-corrodible by soldering acids. This process is known as calorizing, and it does more than to coat the copper, it actually changes the characteristics of the copper to an appreciable depth.

New Points in Paris-Rhone Project.—The project of securing an electric power supply for the city of Paris from the Rhone River is one which has been much discussed, and it seems more likely than ever that it will be carried out. The distance is considerable, over three hundred miles, and the latest plans call for 200,000 horse-power to be taken from the Rhone, near the Swiss frontier. A barrage will be erected upon the Rhone and the electric plant will lie just below it, receiving the water from a canal 170 feet wide and 25 feet deep. A set of sixteen penstocks will lead into the extensive turbine house of 1,000 foot length, and here will be ranged the sixteen turbine-alternator units of 20,000 horse-power size. The head of water is 230 feet and the delivery 10,000 cubic feet per second. Abandoning the high-voltage direct current which was formerly mentioned, the three-phase alternating current is considered to be more in line with modern practice, using 120,000 or even 150,000 volts on the power lines. Beside the turbine house will be erected a separate building of about the same length lying parallel to it and on a higher level, and the various circuits and apparatus for handling the current will be installed here. Cables will run between the two buildings in tunnels. Each of the groups in the turbine houses is made up of a double Francis turbine consisting of two separate wheels on the same shaft, together with a 12,000 volt alternator. The second building also contains the large transformers for raising the voltage from 12,000 to 120,000 for the power lines running to Paris. But it is intended to give a greater extension to the power lines than the original plans called for, and there will now be run a number of other power lines of considerable length so as to cover the surrounding districts. Such lines will be operated at a lower voltage of 30,000 volts. Still another set of lines will serve for the immediate neighborhood of the plant, where it is proposed to furnish a large amount of current for the electro-chemical industries. As regards the power transmission to Paris, the present project drawn up by M. De Valbreuze calls for four separate lines of three wires each, and in the future other lines can be added. The wires will be run on structural iron poles and will be divided into sections 60 miles long. It seems only a question of time before the present project will be carried out; for it is favored at Paris in official circles, as well as by a number of commercial and industrial syndicates in the valley of the Rhone and in the neighboring regions.

Science

Arthur D. Little Elected President of the American Chemical Society.—Mr. Arthur D. Little, who was elected president of the American Chemical Society at its annual meeting in Washington, is president and general manager of Arthur D. Little, Inc., chemists and engineers, 93 Broad Street, Boston, Mass. He has previously held the position of vice-president of this society, and has been chairman of the Division of Industrial Chemists and Chemical Engineers.

A Road-building Experiment Station.—The Road Board of Great Britain is about to establish a novel station for testing different materials and methods of road construction in connection with the National Physical Laboratory, at Teddington. A circular track will be provided, and a number of experimental "roads" will be successively built thereon. On each of these will then be tried the effects of various vehicles, running at various speeds, taking account of width of tires, circumference of wheels, motive power, etc. Laboratory tests will also be made.

The Endurance of Spanish Horses.—The American Consul at Jerez de la Frontera, the most noted center for horse-breeding in Andalusia, ascribes the well-known toughness and endurance of the horses of that region in part to the climate, but principally to their feeding on a rich wild clover, called "zulla," which grows only in the province of Cadiz, and which is claimed to be the finest food in the world for horses. It is never cultivated, but grows wild, to a height of 3 or 4 feet, preferring the same chalky and clayey soil that produces the famous Jerez, or sherry, wines.

A Remarkable Rainstorm at Baguio.—A Correction.—Our recent article on the rainstorm of last July at Baguio, in the Philippines (SCIENTIFIC AMERICAN, December 23rd, 1911, p. 570), in comparing this storm with one that occurred at Cherrapunji, India, in June, 1876, contained the erroneous statement that the maximum fall during four days of the Indian storm amounted to 83.96 inches. The maximum was actually 101.84 inches, for the dates June 12th-15th, inclusive, which exceeds Baguio's record of 88.14 inches for a like period. The Indian record also exceeds the maximum amount in any four consecutive days during the extraordinary rainstorm at Silver Hill, Jamaica, in November, 1909; but the maximum fall in five days at Cherrapunji was a little less than for the same duration of time in the Jamaican storm. It remains true, however, that the torrential downpour at Baguio was one of the most remarkable recorded in the annals of meteorology.

How Leeches Carry Their Young.—It is known that leeches of the *Clepsine* family show an interesting particularity in the fact that the females carry the eggs on their under surface, and when the young are hatched they likewise fix themselves to the surface by means of their suckers. They remain there for some time, until they reach about one-third the length of an adult specimen, then they drop off and become independent. Recently M. Moltschanov, a Russian scientist, observed this fact upon no less than five species of *Clepsine* from central Russia. The number of young is variable, being usually from seven to twelve, but in the case of the *Hemiclepsis marginata* there are often as many as thirty-five small leeches fixed upon the female. If one of them is taken off, it crawls until it meets with an adult leech upon which it becomes fixed. This may even be a specimen of a different family. Sometimes the female is seen carrying the young, but there are one or two of these which are larger than the rest, and these no doubt came from outside and fixed themselves upon the female.

An Unlucky Experiment in City-building.—As compared with the normal process by which towns come into being, their development proceeding spontaneously and by slow stages, it is interesting to note the occasional deliberate construction of large seaports, and other towns, complete and ready for occupancy in a few years' time; the motive being sometimes political and sometimes commercial. We have recently referred in these columns to the remarkable development of Port Sudan, founded a few years ago by the British authorities on the west coast of the Red Sea. A similar undertaking, though with different aims, was the building of the German seaport of Tsingtao, China; a city notable, among other things, for the fact that no American atlas-maker discovered its existence until ten years after its foundation. In contrast to these successful experiments in city-building, we learn that the port of Heungchow, which was laid out in the spring of 1909 on the shore of Yehli Bay, 10 miles by water from Macao harbor (China), has by no means realized the hope of its creators that it would speedily become a formidable rival to the neighboring ports of Macao and Hong Kong. It was built on up-to-date lines, with telephones, waterworks, electric light, tramways, etc., but it has not succeeded in attracting trade, and its present population is only 2,000.

Watching for and Preventing Forest Fires

How the Forest Service is Protecting Our Standing Timber

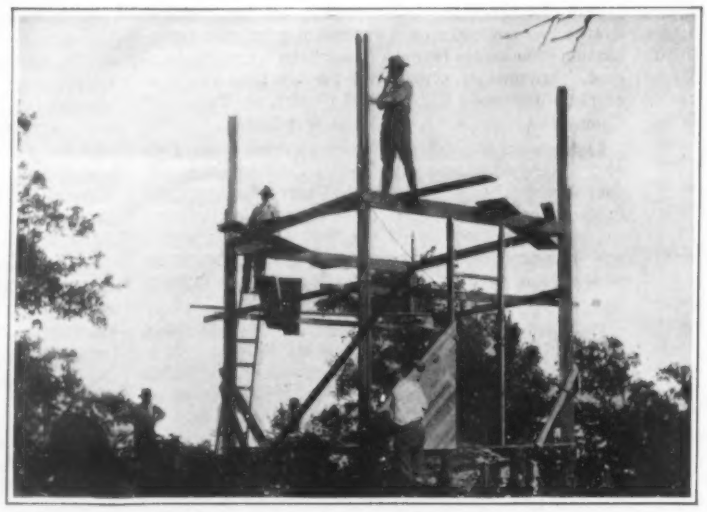
By Day Allen Willey

THE greatest problem connected with the conservation of the country's natural resources is the care and protection of the woodlands in charge of the Forest Service. The many ways in which trees can be destroyed by fires, by heavy gales, and by drouth which dries up the earth below the roots, gives the ranger a task of great responsibility, particularly when it is considered that these men have over 160,000,000 acres of timberland in their charge.

To appreciate the problem one must have a clear conception of the type of country included in the National Forests, and also some idea of its extent. Except for small areas in Florida, Minnesota, Michigan, Kansas, and the Dakotas, the National Forests include the great mountain watersheds of the West. They lie along the crest of the main divides of the Rockies, the Cascades, and the coast ranges. The country is therefore rough and mountainous, cut by gorges and canyons, and broken by almost impassable ranges and by unscalable peaks. There are two general forest types—open park area with timber confined to the north slopes, and densely forested regions where timber grows on both exposures. In the main, the park country of the principal divides and the very heavily timbered regions are in the west.

The work of fire prevention and control, although theoretically the same for both types, differs essentially in practical application. Each national forest, the unit of administration, contains from 1,000,000 to 2,000,000 acres. This is equivalent to an area from 30 to 50 miles wide and from 40 to 60 miles long. To protect such an area from fire, especially in view of the difficulties of transportation and communication, is exceedingly difficult.

Fire insurance appraisers, who have investigated various causes of ignition in cities and towns, concur in the conclusion that fully 90 per cent of the fires were due to causes which could have been avoided. Much of the loss by the flames in the woodland can be prevented. This statement is based on the opinion of the heads of the Forest Service division throughout the West, who have carefully studied the situation. As a result of their efforts, the service has already begun to execute plans which have proved to be practical and successful, either in preventing fire or in extinguishing it so soon after its origin that it did no damage. The burning of the timber means not only a loss in stumpage, but a community loss in wages of approximately $10 for every thousand board feet destroyed. When it is realized that it is not uncommon for the timber to run from 50,000 to 100,000 board feet per acre in the dense forests of the Pacific Northwest, it is clear that it does not take very many burned acres to run the figures up to six or seven places. For example, from one year's fires in Montana and northern Idaho the loss was 6,000,000,000 feet board measure, with an estimated value of $20,000,000. Aside from the value of the timber the danger to lives and to town property from these large fires is a very great menace.



Building an observation tower to watch for fires.

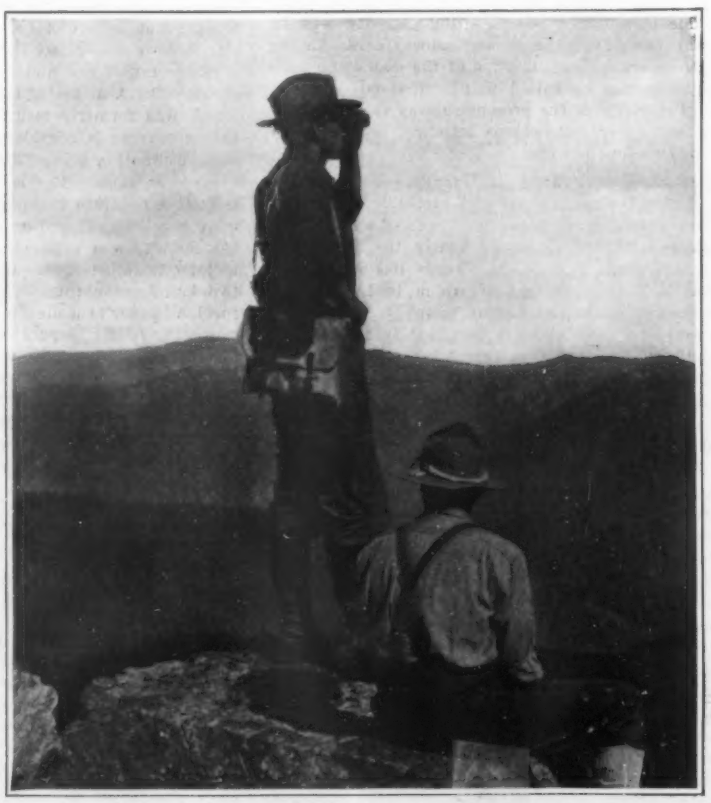
Rangers' telephone for giving fire alarms and reporting to their chief.

Always the first question when the fires are mentioned is: "How do all these fires get started?" The usual causes in the order of their frequency are: Railroad engines, lightning, careless campers, fishermen, and hunters; settlers burning brush to clear land for cultivation; logging engines and sawmills; malicious incendiaries. Out of 3,138 fires reported, 1,186 were caused by locomotives, and their setting was due to three principal reasons—the use of coal as fuel, the lack of proper clearing of the right of way, and the non-use of spark arresters.

The railroad's right of way is usually from 100 to 200 feet wide. In many places within the National Forests the brush and debris have never been properly cleared up on the right of way after the larger timber has been removed, and

(Continued on page 56.)

Running telegraph lines through reservations for rangers' use.



Ranger sweeping the Rocky Mountains for forest fires.

FIRE PROTECTION IN THE ROCKY MOUNTAIN FORESTS.

Two Novel French Aeroplanes

Description of the First Aerial Taxicab and the Paulhan-Tatin Aerial Torpedo

TWO distinctly novel aeroplanes which have recently been produced in France are shown on this page. The most interesting of these machines for the average person is undoubtedly the taxicab built for M. Henri Deutsch de la Meurthe, by Louis Blériot. This latest Blériot monoplane, while intended as a private conveyance, has been dubbed an "aero-taxi" on account of the similarity in design of the body and the arrangement of the seating of the aviator in front, as in the ordinary auto taxicab. In general design, this machine resembles somewhat the original "Blériot XII." Like Blériot's first passenger-carrying monoplane, the passengers are seated in the center below the main plane; but in all other respects this machine is different. It has a horizontal rudder far out in front, instead of at the rear, and the 14-cylinder, 100-horse-power Gnome motor, with its propeller, is mounted at the rear of the main plane instead of at the front. A torpedo-shaped fuel tank is placed just above the roof of the cab in front of the motor. The machine is controlled by the usual Blériot method, consisting of a universally mounted post having an aluminium bell at the bottom part to which the control wires connect. Triple heavy elastics are used for shock absorbers in order to sustain the considerable weight. The machine complete, but empty, weighs 1,540 pounds and has a supporting surface of 430½ square feet. The spread of the main plane is 43 feet, and the over-all length of the machine is 46 feet. There are some 20 square feet in the front of the cab body which, it would seem, would form a very detrimental head resistance. Nevertheless, the machine has flown successfully, as can be seen from one of our photographs.

The seats in the body are fitted with pneumatic cushions which take up the shock in case the machine alights heavily. There is also a speaking tube so that the passengers can readily communicate with the pilot. The machine is capable of carrying three people all told, and of flying at the rate of 50 miles an hour.

This is the first time that an aeroplane has been built and flown in which special pains were taken to construct it with a comfortable body for the carrying of passengers. If the owner makes a few successful pleasure flights he will no doubt open the way for a regular line of aeroplanes with closed bodies for those who want to make flights in perfect comfort and be thoroughly protected from the weather. Perhaps before another year passes we shall see the establishment of a regular aerial taxicab service.

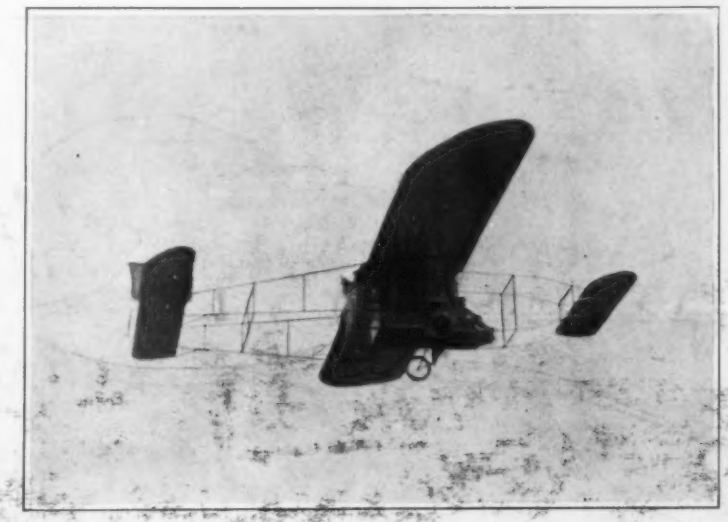
The Tatin-Paulhan Aerial Torpedo.

The peculiar aeroplane with torpedo-shaped body illustrated herewith was constructed after the designs of M. Victor Tatin by Louis Paulhan a short time ago. The machine was designed by Tatin more than twenty years ago, and he has argued for this design in several brochures and books which he has published. The torpedo-shaped body is said to give the least possible head resistance, whereas the upcurving of the wings at their outer ends has been found to give sufficient stability so that wing warping is said to be unnecessary. The machine is provided with a flat tail, the rear part of which is movable and forms the horizontal rudder. The vertical rudder is mounted above the body at the same point as the tail. The pilot's seat is located in the body just forward of the wings, and the 50-horse-power Gnome motor is placed just back of the pilot in a compartment which can be noted by the cover which closes it on the side of the body below the wing.

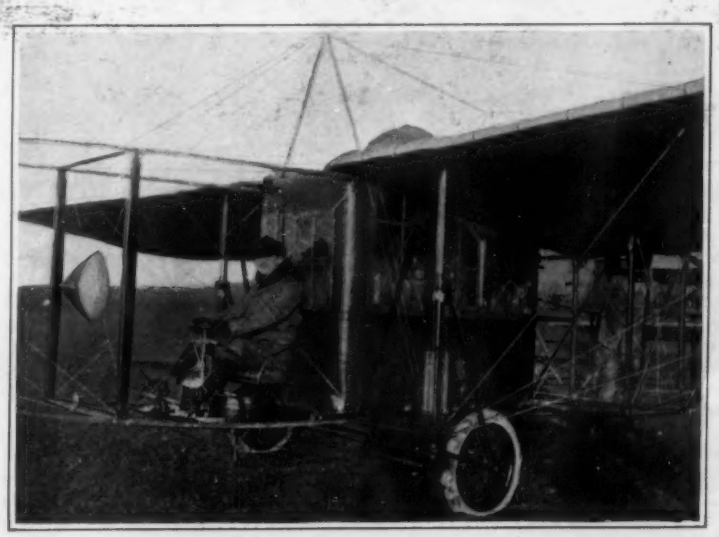
The chief peculiarity of this machine is the placing of the propeller at the extreme rear of the body instead of at the front, as is usual in monoplanes. The propeller is driven by means of a long universally-jointed shaft running back from the motor and carried in five bearings supported by piano wire guys. The machine rests on two semi-elliptic pieces of wood, the rear ends of which are connected by a cross piece to which shock absorbers are affixed.

This machine has fulfilled in every way the expectations of its designer, who figured that with 22 horse-power and a certain sized propeller it would travel 77 miles an hour, whereas with 40 horse-power, a speed of almost 100 miles an hour would be obtained. The machine has shown itself to be very speedy and also to be a good flyer. Complete details and dimensions will be found in SUPPLEMENT No. 1878.

Side view of torpedo monoplane, showing propeller at rear end of body.



The aerial taxicab viewed from beneath, in flight.



Near view of monoplane taxicab, showing closed body.

TWO NOVEL FRENCH AEROPLANES

The Upper Trade-winds

ON each side of the earth's equator lie the trade-wind belts, in which the air flowing equatorward from the tropical high-pressure zones, and deflected to the westward by the earth's rotation, provides the mariner with tolerably steady and constant easterly winds—northeasterly in the northern hemisphere and southeasterly in the southern. Evidently the air thus drawn toward the equator at the earth's surface must ultimately find its way back to higher latitudes. Observations of the movement of clouds, and in recent years of pilot-balloons, have shown that it does so at an altitude of a few thousand feet above the ground, where the winds blow in a direction opposite to that of the trades, constituting what are variously known as the *antitrades*, *counter-trades*, or *return-trades*. (The usual term nowadays is *antitrades;* but a generation ago this expression was applied to quite a different phenomenon, viz., the prevailing westerly winds of middle latitudes.)

Do the antitrades extend upward indefinitely? If not, what system of winds prevails above them? There appears to be an upper limit to the antitrades, but it lies above the highest cloud-level, and our knowledge of the atmosphere at this great altitude depends upon a few exceptionally high ascents of balloons.

Westerly and southerly winds not belonging to the antitrade system were first observed by Berson, in Central Africa, during the historic German expedition of 1908. The observation has since been confirmed by sounding-balloon ascents in Egypt and Java. These winds are feeble and variable, and in them Dr. W. van Bemmelen, director of the Observatory of Batavia, sees a transition stage between the antitrades and a still higher regular system of winds blowing toward the equator, i. e., in the same general direction as the trade-winds at the earth's surface. Their altitude is roughly stated at 12 miles. Dr. van Bemmelen, who has communicated his observations to *Nature*, proposes to call these winds the "upper trade-winds." Their existence had previously been suspected on theoretical grounds, since at this altitude the air-pressure gradient is believed to be positive from the subtropical zones toward the equator.

If Van Bemmelen's discovery is confirmed by subsequent investigations, we shall have the following vertical arrangement of the air currents in the trade-wind belts: Upper trade-winds, transition layer of variables, antitrade winds, transition layer of variables, trade-winds.

Wireless Weather Reports from the Eiffel Tower

RECENTLY the French government put into effect a plan for distributing meteorological information to vessels on the Atlantic by wireless from the Eiffel Tower. This information takes the form of a daily bulletin issued each day immediately after the time-signal (11 A. M., Greenwich time). The message gives the barometric pressure, the direction and the force of the wind, and the state of the sea at the following six points: Reykjavik (Iceland), Valentia (Ireland), Ouessant (France), La Coruña (Spain), Horta (Azores), St. Pierre-Miquelon (off the coast of Newfoundland); at the first five stations the observations are those made at 7 A. M. of the current day; at the last-named station at 8 P. M. of the preceding day. These stations constitute a sparse fringe around the basin of the North Atlantic, and their reports will enable mariners to gain at least a general idea of the weather situation over that expanse of ocean.

The despatch gives the initial letter of the name of each station, followed by two figures indicating the pressure in millimeters (+ 700); then two figures for the direction of the wind (from 02 = NNE to 32 = N); then one figure for the force of the wind on a scale of 0 to 9; and finally one figure for the purpose of denoting the condition of the sea, from 0 = calm to 9 = furious.

Following the reports from the six stations is given a brief statement of the weather conditions over Europe, especially the position and movement of cyclones and anticyclones.

The Gas-driven Vessel "Holzapfel I."

A Successful Application of the Marine Producer-gas Engine

INTEREST in the application of power-gas to the propulsion of large vessels has been centered upon the English gas-driven craft "Holzapfel I." During the present year the vessel has been in service around the British coast.

The "Holzapfel I." is a sea-going craft of 300 tons. The ship was built to demonstrate the practical value of power-gas propulsion, at the order of the Holzapfel Marine Gas Power Syndicate, Limited, of London, which was formed especially for the purpose. Owing to the many peculiar features associated with the problem, collaboration was effected between the builders of the hull, power-gas plant, and engines, respectively. The idea was prompted by the success of the power-gas plant at the Holzapfel works at Newcastle-on-Tyne, which installation has worked without the slightest hitch for over five years, producing gas power at the cost of 1½ cents of bituminous coal per indicated horse-power. The complete success of this land station prompted the adaptation upon a practical scale of the system to shipping.

At the outset the most difficult problem was the reversing of the engine, and various efforts were made to obtain a reversible gas engine, but without success. Electric reversing was then contemplated and a vessel was projected using electricity for reversing, maneuvering, and slow speeds. However, when Prof. Föttinger of Stettin perfected his hydraulic power transformer, and its suitability to marine work was recognized, it was decided to adopt this system rather than electricity, because it is lighter, less costly, has a higher efficiency, is safer; is very reliable, and the cost of maintenance and repairs is lower.

The hull was constructed at the shipyards of Messrs. J. T. Eltringham & Co. of South Shields, to whom we are indebted for the accompanying illustration. The vessel measures 120 feet length, by 22 feet beam, and 11½ feet molded depth. It is intended to carry some 300 tons deadweight on a draft of 10 feet. It was necessary for the purpose of trim, to construct a deep ballast tank amidships, and to have two hatches instead of one as is usual in a vessel of this size. The engines and gas plant are placed aft and occupy about the same space as boilers and compound engines of similar size.

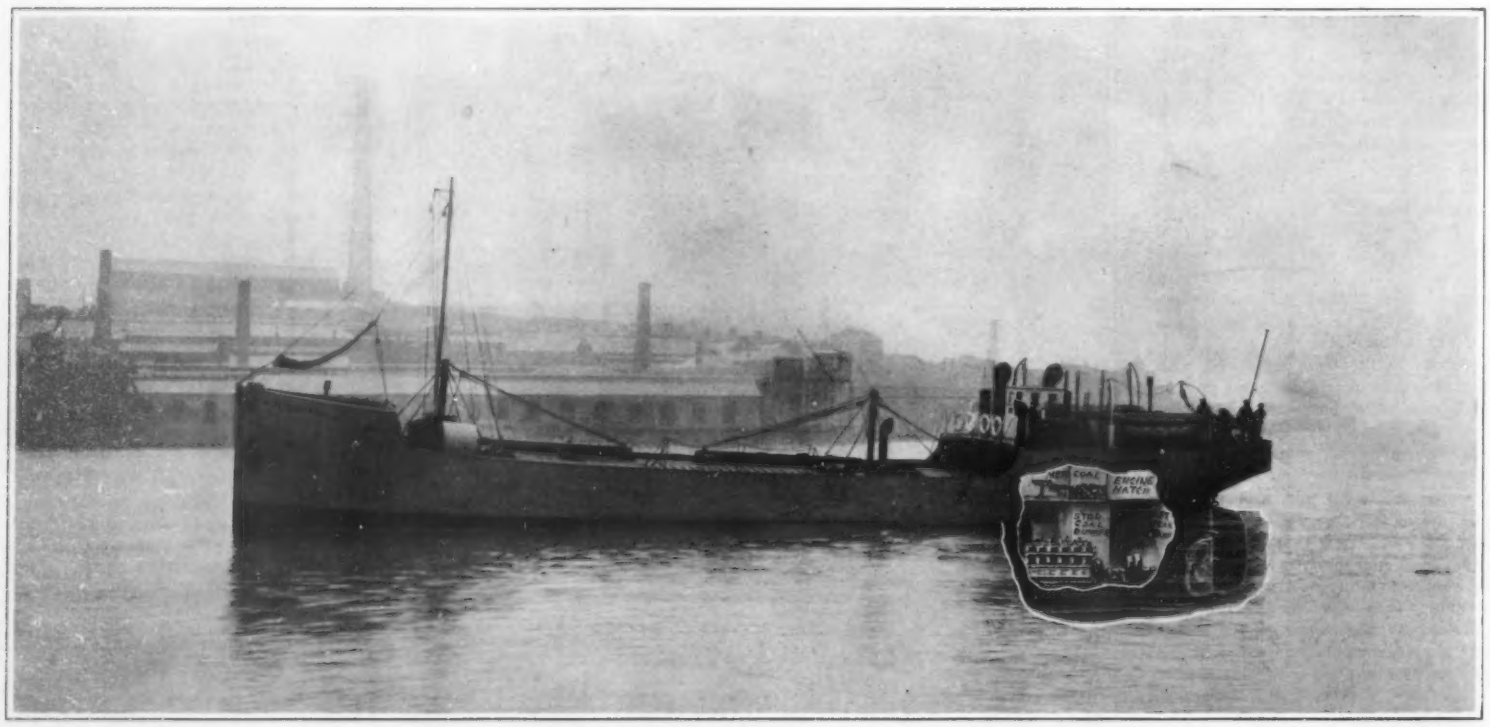
The design and construction of the gas plant was intrusted to the Power-Gas Corporation of Stockton-on-Tees, who have carried out numerous stationary power gas installations. There are two generators, each of 100 horse-power, together with two vaporizers and scrubbers. The whole gas plant is placed upon an elevated gas-tight platform 3¾ feet above the keel of the ship and inclosed by water-tight bulkheads. The two producers, each carried on a base 3½ feet square, are mounted side by side the two fronts forming part of the bulkhead. The vaporizers are placed behind the producers. The two scrubbers each measure 13 feet in height by 2½ feet in diameter, the upper being the wet portion. The cooling, and the circulating water for the engines are drawn from a tank fixed on the poop deck and supplied by pumps which can be driven either by the main engine or by an individual paraffin motor.

The space carrying the gas plant is fitted with a gas-tight door. When the vessel is at sea, unless anything unforeseen happens, there is no occasion to enter this compartment. Each generator is equipped with blow-off pipes, the valve of which is opened before the engines are stopped. Leakage between each producer and scrubbers, likely to arise from straining, is overcome by means of a flexible pipe connection. The gas plant space is ventilated by two special 12-inch ventilators having induced ventilation by a small pipe supplying compressed air from the air compressors. As the fronts of the producers are toward the engine room it will be seen that no leakage of gas can get to the fires, and that the danger of explosion is avoided.

The gas engine is of the high speed type built by E. S. Hindley & Sons of Bourton, Dorset, who have made a speciality of high speed vertical engines. It is of 180 brake horse-power and has six cylinders each of 10¾ inches bore by 10 inches stroke. The designed running speed is 450 revolutions per minute which is reduced by the Föttinger transformer to 120 revolutions per minute for the propellor shaft. Low tension ignition working on the Sir Oliver Lodge system is used with accumulators, etc., a small dynamo being provided for recharging the secondary batteries.

The Föttinger transformer, as an intermediary between the gas engine and the propeller shaft, can reduce the revolutions of the latter to whatever is desired within certain limits, the gas engine meanwhile working at full speed. It can also stop or reverse while the engine is working at full capacity ahead. Its action is almost instantaneous and has been found to be considerably more rapid than that of steam engines. Its introduction entails a loss of power varying from 3 to 20 per cent according to size, and to the ratio of the number of revolutions of the prime mover to those of the propeller shaft. A very favorable ratio is say from 300 revolutions of the gas engine to 100 of the propellor shaft, and this in general practice enables a high speed gas engine of light weight and low first cost to be used with a propeller of high efficiency.

The bunker, of 12 tons capacity, is placed between



THE "HOLZAPFEL I.," DRIVEN BY PRODUCER-GAS ENGINE THROUGH A FOETTINGER HYDRAULIC REDUCTION GEAR.

decks. The consumption averages about 3,100 pounds of coal per 24 hours and the speed about 7½ knots.

The operation of the vessel has proved entirely satisfactory, and the anticipations entertained at the time of its construction have been fulfilled. The Föttinger transformer proved completely successful; and the owners of this craft who have acquired the British patent rights in the transformer are prepared to build marine installations fitted therewith up to 6,000 horse-power. While the weight of the gas engine plant is greater than that of an oil engine of equal horse-power, the relative costs of the two systems differ very slightly. So far as the cost of running is concerned the advantage rests with the gas-driven ship, and represents from 40 to 60 per cent. This factor is a variable one, however, for oil fluctuates in price in different parts of the world, and the increasing consumption is tending toward a steady increase in its cost.

Our Attitude Toward Pioneer Work in Science

IN a paper presented before the Congress of Technology at the Massachusetts Institute, Prof. A. Sauveur referred to the position taken by America in relation to scientific research. His words are well worth quoting:

"In metallography as in other fields of research, American workers, with few exceptions, have been quite willing to let Europeans perform the arduous and generally unrewarded task of the pioneer, being content to wait, before entering the field, until practical results were fairly in sight. Such a course, which is never to be concealed, becomes intolerable when accompanied, as it so frequently is, by the coarser boasting attitude of the man believing himself smarter than his neighbor whom he regards in the light of a cat drawing the chestnut from the fire. America, barring brilliant exceptions like Richards at Harvard, and Noyes at Massachusetts Institute of Technology, does not as yet do her share of the pioneer's work in investigations which do not give evident indications of quick commercial returns. The unselfish, nay self-sacrificing spirit of the true scientist is of far rarer occurrence in the United States than it is in Europe and especially in France. America has not yet produced a Pasteur nor a Berthelot, intellectual giants, profound scientific thinkers, whose conception of the duty of the scientist as a man is so lofty that they have despised the wealth within their easy reach to devote themselves unreservedly to the betterment of their country or rather of the world, for they are morally so great that the entire world becomes their fatherland; humanity claims them."

Curiosities of Science and Invention

Double Narwhal Tusks

A RARE double tusk narwhal, considered to be the record breaking specimen of the world, has recently been added to the National Collection of Heads and Horns at the New York Zoological Park. This is a gift from Mr. H. Casimer de Rham, of New York, and was purchased in Scotland for $450. It was captured by a whaler in the Arctic seas. The tusks are nearly eight feet long and the animal must have been 25 feet long. The narwhal ordinarily possesses but one tusk, and in the few examples hitherto known with two, the additional appendage has always been dwarfed in size and length to about half of the natural one. The tusk is hollow and is spirally grooved or twisted. Its use is thought principally to be for breaking through the ice to obtain breathing spells and also as a weapon of defense. The body portion, which averages from 10 to 15 feet long, is dotted with black and white spots. The "blow hole" is on the top of the head, the eyes and mouth are small. A school of half a hundred or so are said to form a most picturesque sight when seen plowing through the water, their long, glittering horns elevated in unison as they rise to "blow." The narwhal is one of the favorite food animals of the Greenland Eskimo and other Arctic peoples. In the winter and spring they are harpooned by the natives through open fissures in the ice, as the animals are compelled at certain intervals to rise to the surface for fresh air.

Double narwhal tusks eight feet long.

Gourd-shaped orange.

"Chicken-foot" lemon.

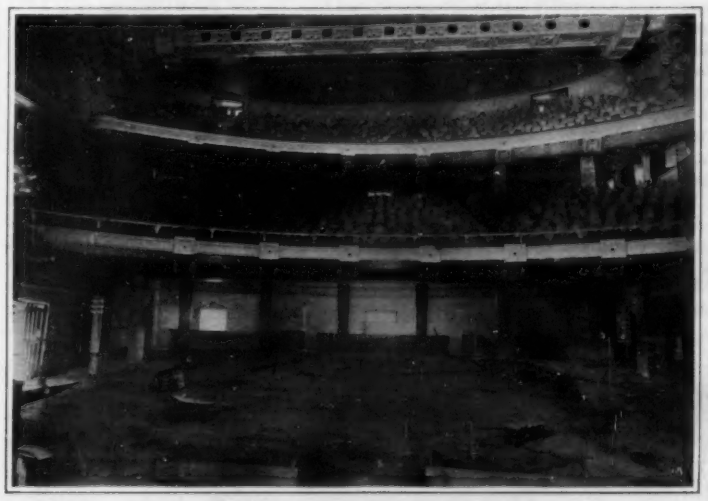
A Novel Automobile Bicycle

OUR illustrations show an ingenious motor bicycle which has recently been brought out in Berlin, in which the rider sits in a comfortable seat and is never in any danger of upsetting. The reason of this is that to a wide frame at the bottom there is attached at either side a small wheel which is normally off the ground, when the machine is under way. When it comes to rest, however, it tips to one side and the small wheel holds it upright. This is a great improvement, especially as there is never any danger of the bicycle's upsetting on slippery asphalt or a rutty road. We have not the particulars of the power plant, etc., but we presume that the bicycle machine is fitted with a clutch and two-speed gear such as are being used on most up-to-date motor bicycles in this country at the present time.

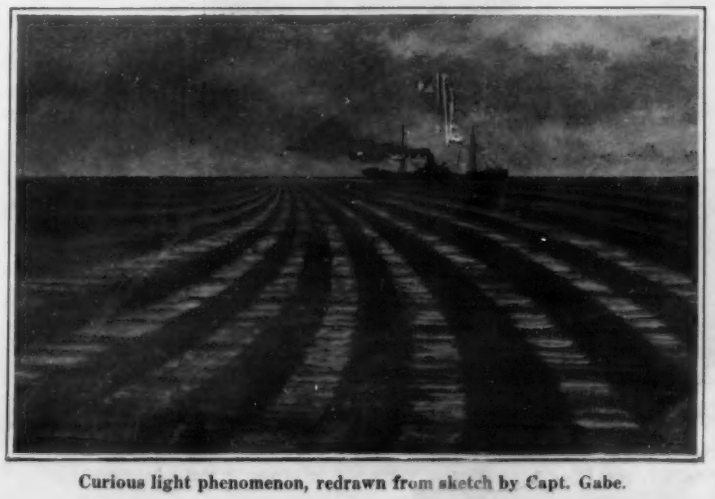
Automobile bicycle with side wheels to prevent upsetting.

Test of a Concrete Theater

THE first glance at the accompanying photograph may give one the impression that the balcony and the gallery of the theater are well packed with an attentive audience. Closer inspection, however, will reveal the fact that the seats are filled with bags of sand and cement rather than human beings. The photograph was taken during a recent test of a theater in Colorado Springs to determine its strength and ability to meet the city building requirements. It will be observed that the balcony and the gallery are built of reinforced concrete with no supporting posts, so that an unobstructed view may be had of the stage from any part of the house. The gallery was loaded with 768 sacks of sand, each weighing 100 pounds. Two sacks were placed on each seat and four sacks on each step of the four aisles. The balcony was loaded with 1,124 sacks similarly distributed. The city engineer took levels with a Berger level and self-reading rod, reading to hundredths of a foot, and the maximum variation was but 0.05 foot. On the next day, using the same level and rod, and taking elevation from a bench mark outside of the building, levels were run over the same points, showing a maximum deflection of 0.01 foot. After the sacks had been removed, another series of levels gave the identical results obtained in the first instance. Probably there was absolutely no deflection, since in reading to hundredths of a foot, a very slight variation in the plumbing of a rod will show as much difference as one hundredth of a foot.



Testing a theater with a heavy-weight audience.



Curious light phenomenon, redrawn from sketch by Capt. Gabe.

Malformed Citrous Fruit

TWO very peculiar specimens of citrous fruit, one a lemon and the other an orange, were sent to the Editor of the SCIENTIFIC AMERICAN not long ago by Frederick W. Martin, who oversees the packing of a great deal of California fruit. These two curiosities are illustrated herewith. The lemon had very much the appearance of a chicken's foot, the color and texture of the skin being almost exactly like that of certain breeds of poultry, and even the claws being represented by hardened brownish tips at the ends of the toe-like projections. It is impossible to explain the formation of such fruit except as a freak of nature. The lemon was about four inches long. Mr. Martin informs us that he frequently finds peculiar shaped lemons of all sizes, some of them even a foot long. The orange pictured herewith was of rather an odd shape and not much more than two inches long. The skin was thin and it was filled with juicy pulp. This was not the case with the lemon, which consisted almost entirely of skin. It is a common thing to find among oranges of normal size perfect little miniatures less than two inches in diameter.

Curious Light Phenomena of the Indian Seas

QUEER things still happen at sea. Every now and then a vessel-master reports the observation of some phenomenon that defies explanation in the light of our present knowledge, and forcibly reminds us of the uncanny inventions of writers such as Poe, who have found the sea a particularly available theater for mysterious happenings.

In the *Nautical-Metcorological Annual*, published by the Danish Meteorological Institute, appears a report from the master of the Danish East Asiatic Company's steamer "Bintang," Captain Gabe, of a singular luminous phenomenon observed on the surface of the water when the ship was passing through the Strait of Malacca in June, 1909. At 3 A. M., June 19th, he was roused by the second mate, and went on the bridge, where the mate had been watching the phenomenon for some minutes. The latter reported that he first saw light-waves traveling in the water from west to east. Gradually the light-waves took the form of long arms issuing from a center, around which the whole system appeared to rotate. The center, which seemed to lie on the horizon—the other half of the system not being visible—moved from right astern to the starboard beam. When the captain came on deck the phenomenon resembled the beams from a revolving light, with a pretty fast rotation; the light itself not being visible.

The system moved forward, decreasing in brilliancy and in speed of rotation, and at last disappeared when the center was right ahead. The phenomenon lasted about fifteen minutes.

The system was perfectly regular, the breadth of the rays along the side of the ship being about six feet, and that of the intervening spaces twice as much. The light was evidently in the water, as it did not light up the deck nor the side of the ship more than the common phosphorescence of the sea, of which there was a good deal. The rays were curved with their concavity in the direction of the rotation.

(Concluded on page 58.)

The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting

Edison's Concrete Furniture

SOME time ago the startling announcement was made that Thomas A. Edison was working on a scheme for "pouring concrete houses," in other words, that he planned to set up forms for a practically complete house, and cast the house in these forms by pumping them full of a very fluid concrete mixture. Thus, in about twenty-one days, which is the time estimated it would take for the complete house to be cast, not only would the walls, floors and roof be in place, but even decorations, cornices, bath and laundry tubs and plumbing.

While this scheme has not yet fully materialized, Mr. Edison is making considerable progress with it, and in the meantime has conceived the idea of building furniture of concrete, for use in his concrete houses, the advantage of concrete furniture lying in its cheapness. He has already built a sample piece of furniture, which is shown in the accompanying illustration. It is a phonograph cabinet, finished with white enamel and gold trim.

The harsh grain that we associate with ordinary concrete structures is missing, and the cabinet compares very favorably with expensive wooden cabinets. For purposes of comparison a wooden cabinet has been included in the photograph on Mr. Edison's right.

The cost of this cabinet is but $10. Mr. Edison explains that this will not be the selling price, and he does not venture to name the store price of the cabinet, as he has no idea how much the middle man may require for his share of the profits. In order to test the ability of this piece of furniture to stand the rough handling of freight men, he recently sent the furniture to Chicago and back.

He explains that it is not necessary to have a white finish on all concrete furniture, but that it may be stained to look exactly like any kind of wood. When Mr. Edison reaches success with his concrete houses and is able to build them for $1,000, he expects to be able to completely furnish such a house with concrete beds, tables, etc., at about $200.

Expiration of the Berliner Talking Machine Patent

THE Berliner patent, which was granted February 19th, 1895, and which the courts have upheld as valid and finally decided would not expire until the end of its full term of seventeen years, has had a history involving points interesting to both laymen and patent experts.

The patent covers what may be called the fourth decided step forward in the development of the modern talking machine; the invention being that of Mr. Emile Berliner, who was also the inventor of what is known as the "loose contact telephone transmitter," a decided step forward in the development of the telephone art.

Copyright 1911 by Underwood and Underwood.

Thomas A. Edison and his concrete furniture.

The white cabinet is of concrete, the other of wood.

The first step in the talking machine art, like the first step in many other arts, was rather scientific than practically useful. Leon Scott in 1857 published his discovery that if sound waves be projected against a diaphragm having a hog's bristle glued thereto, and the end of the bristle be held against a moving paper covered with lampblack, so long as no sound is heard the bristle remains at rest and traces a straight line on the moving paper, but when a sound is heard the diaphragm and bristle vibrate in unison, and the line traced on the moving paper is no longer straight but undulating.

The second decided step in the development of the talking machine was taken by Mr. Edison, and is disclosed in his patent, No. 200,521.

Mr. Edison utilized Leon Scott's scientific discovery of the fact that sound produced the undulatory motion of the diaphragm and bristle, and constructed the apparatus shown in Fig. 1, which consists of a cylinder *A* on a shaft *X*, the cylinder being covered with tinfoil. A diaphragm *F*, having a needle *D* fixed thereto, was used to produce the undulatory lines. Mr. Edison found that when a reproducer needle *R*, fastened to the diaphragm *G*, was made to track along in the undulating line made by the needle *D*, it would reproduce the sound that produced the undulations.

The third great step forward in the talking machine art is disclosed in the Bell and Tainter patent of May 4th, 1886, wherein among other things the record instead of being indented, as by the Edison needle *D*, above, *cut* the record groove with a cutting tool or recorder, as indicated in Fig. 2.

It will be noticed that both in Edison and in Bell and Tainter the grooves are of different depths or what are called "hill and dale" record grooves. One disadvantage of such a record is that the reproducer, in afterward tracking a "hill and dale" record, when it passed over a "hill" was liable to jump over into the next groove. Mr. Berliner in his fourth great step in the development of the talking machine kept the depth of his groove always the same, and caused his recording stylus to cut sidewise, producing the record shown in Fig. 3.

This Berliner record groove obviates the liability of the reproducer jumping from one groove to another, and feeds the reproducer stylus along without the aid of a separate feed screw.

Mr. Berliner called his machine a "gramophone," to distinguish it from the "graphophone" or "phonograph." The marked difference between them being that in the "gramophone" the reproducer is fed along by the groove itself, whereas in the "graphophone" or "phonograph" the cut groove being a "hill and dale" groove, requires a separate feed screw.

As in nearly all cases of patents for valuable improvements, the owners of the Berliner patent were soon compelled to go into the courts to maintain their monopoly, and in their first big fight it was alleged that because Berliner had exhibited his machine before the Franklin Institute in 1888, more than two years before he applied for his patent, this *use* of his machine invalidated his patent, since a patent must be applied for before it has been in *public use* more than two years. The Courts held (140 Fed. Rep., 860) that such use as the exhibition use, which was free and not for gain, was a mere experimental use and did not invalidate the patent.

Before the second big suit began, Berliner had allowed his Canadian patent, granted February 11th, 1893, to become forfeited for non-payment of a tax thereon. The question arose whether or not the American patent expired when the Canadian patent lapsed under R. S. 4,887, then in force, limiting the term of all United States patents where the same inventions were patented abroad to expire at the same time with the foreign patents. The court held (146 Fed. Rep., 534) that since the Canadian patent was originally granted for a term of eighteen years from February 11th, 1893, the United States patent did not expire when the Canadian patent lapsed.

The court should have stopped there, since that decided the only question before it, viz.: Did the United States patent expire under R. S. 4,887 when the Canadian patent lapsed? But the court went on and decided something not before it, namely, that the United States patent would expire February 11th,

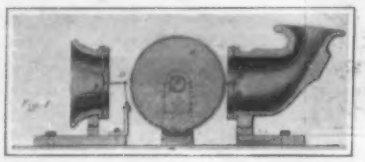


Fig. 1.—Edison phonograph based on Leon Scott's discovery that sound can produce an undulatory motion of a diaphragm and bristle.

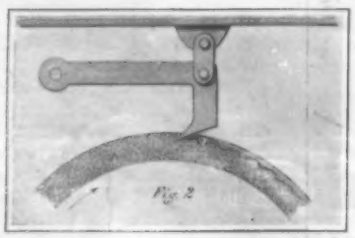


Fig. 2.—Bell-Tainter cut groove.

Copyright 1911 by Harris and Ewing.

Emil Berliner.

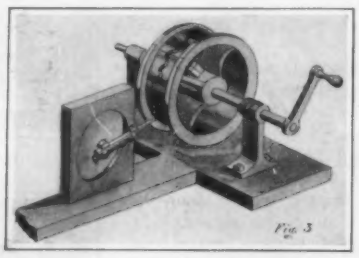


Fig. 3.—Berliner's method of maintaining a constant depth of groove.

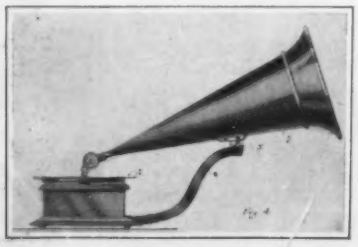


Fig. 4.—The Berliner "gramophone."

EMIL BERLINER AND HIS TALKING MACHINE IMPROVEMENTS

1911, which created considerable confusion as will be seen later.

The third great fight in the courts was over the question whether or not such a device as that shown in Fig. 4 infringed claim 5 of the Berliner patent, which in effect calls for a talking machine reproducer which is moved along the record by the sound grooves alone. In this Fig. 4 it will be noted that 5 is a spring which, when the reproducer 7 is at the center of the record 2, is twisted, and the spring 5 tending to untwist as the record 2 rotates, will tend to move the reproducer out to the surface.

It was held (177 Fed. Rep., 248) that the device claimed did infringe Berliner's claim, even though the reproducer was not moved entirely by the record but was assisted by the spring 5.

The fourth fight in the courts involved the question whether a maker of the records alone infringed a claim calling for a sound reproducer moved along the record by the sound grooves alone. The court held (150 Fed. Rep., 147) that where the record was evidently intended to be used to so move a sound reproducer, it was a clear case of contributory infringement.

The fifth and last big fight in the courts arose over the question of the time when the patent would expire. In the second suit above mentioned it was unnecessarily decided that the patent would expire at the expiration of the Canadian patent, namely, February 11th, 1911, but its owners raised the point that the Canadian patent was for a different invention from the United States patent and therefore should not limit the seventeen-year term of the United States patent.

The claim of the United States patent was: "The method of reproducing sound from a record which consists in vibrating a stylus and propelling the same along the record by and in accordance with the said record."

The claim of the Canadian patent was: "A rotating record tablet, a reproducing stylus mounted to have a free movement over the surface of the record tablet."

The Court of Appeals of the second circuit (not yet reported) held that although this question had been decided years before, it should not have been, since its decision was not necessary to the matter then before the court, and also held that the Canadian patent was for a different invention from the United States patent and therefore the United States patent would not expire until February 19th, 1912, the end of its seventeen-year term.

Besides the foregoing, numerous other suits have been brought to restrain infringements of this patent, involving matters that have been settled in accordance with the foregoing five major decisions, which have cleared up many legal points heretofore unsettled in the patent practice.

The patent has been a veritable gold mine to its owners, and as is too unusual, Mr. Berliner, the inventor, has shared largely in the financial rewards which result from the monopoly given inventors.

The Cottrell Fume-condensing Patents

IN the issue of September 30th, 1911, of our SUPPLEMENT, we published a detailed account of a process of electrical fume precipitation, worked out and patented by Prof. F. G. Cottrell. Since then an interesting development has taken place in the patent situation, inasmuch as the inventor has assigned certain of his patents to the Smithsonian Institution, with suggestions as to the purposes to which the proceeds are to be applied. At the time that Prof. Cottrell worked out his process he was a member of the faculty of the University of California, but he has recently accepted the appointment of Chief Physical Chemist in the Bureau of Mines.

Prof. Cottrell, who, it may be remarked incidentally, completed his training under Prof. Wilhelm Ostwald at Leipzig, was working in his laboratory along the lines first laid down by Sir Oliver Lodge for the precipitation of suspended particles by electrical charges. As a result of his investigation he finally worked out a process, not of merely scientific, but of great technical, interest, which has been tried out in a number of factories, as described in our article referred to above.

The principal utility of the process will no doubt be found in connection with large smelting institutions, which belch forth into the atmosphere large volumes of acid fumes and other objectionable products, to the detriment of vegetation and animal life around. Such conditions are not only highly objectionable to the community, but are sources of loss to the smelters themselves, even when they do not find themselves involved in law suits on account of damages done to neighboring property. Another application of Prof. Cottrell's process would be the precipitation of smoke from bituminous coal fires. Prof. Cottrell, however, suggests that this is the wrong end of attacking the situation; that coal should be so burned that no smoke at all is formed; until this is done, however, the utility of his important invention for this purpose must not be overlooked.

The invention in its entirety is not that of Mr. Cottrell alone but is covered by a number of patents, the joint inventors joining with Mr. Cottrell in assigning the inventions covered in the different patents Nos. 987.114 to 987,117, inclusive.

In the meantime some licenses have been given to persons in the West who, realizing the importance and utility of the invention, have been clamoring for rights to use the improvements; but the terms of the gift to the Smithsonian Institution include the transfer of the specified share of the fees resulting from these licenses.

A Memorial Honor to a Pioneer Inventor

AVIATION as it exists to-day is regarded by many as the result of the dreams and earnest active efforts of Samuel Pierpont Langley, who was one of the first scientists in his class to approach the subject of mechanical flight seriously. It has been said that the international fame of Samuel Pierpont Langley rests primarily upon his epoch-making researches in solar physics, but during the last ten years of his life he was best known in the world at large by his experiments in mechanical flight. He sought to produce a machine heavier than air, and carrying an engine, which would operate to propel the machine and cause it to be supported in the air without extraneous lifting or sustaining power. A model of his made the first independent flight in history as early as May 6th, 1896, on which occasion he had a celebrated and reliable witness in the person of Dr. Alexander Graham Bell. On that day Dr. Bell made a photograph of Prof. Langley's aerodrome in flight, which photograph so closely resembles the current pictures of aeroplanes as to be readily mistaken for the photograph of such a machine. Thereafter Prof. Langley continued his experiments and constructed other models some of which were driven by steam and others by gasoline engines and made frequent successful flights. He was the first to demonstrate practically by actual operating machines, the possibility, if not the entire practicability of mechanical flight. His high reputation as a scientific man and a careful observer gave an impetus to experiments in mechanical flight that was only retarded.

The history of Prof. Langley's experiments and the actual results secured by him are recorded in the reports and other publications of the Smithsonian Institution. It is now proposed to erect in the vestibule of the Institution, at Washington, a Langley memorial tablet, a model for which has been accepted by the Board of Regents of the Institution. This tablet is to commemorate the aeronautical work of Samuel Pierpont Langley. It has been designed and modeled by Mr. John Flanagan, a sculptor of New York city, and is now in readiness to be cast in bronze. Mr. Langley is represented as sitting on a balcony in a reflective mood, and near the top of the field of the relief are to be seen soaring birds, and with them appears his aerodrome in full flight.

The wording of the tablet reads as follows:

SAMUEL PIERPONT LANGLEY,
1834-1906
Secretary of the Smithsonian Institution
1887-1906
DISCOVERED THE RELATIONS OF SPEED AND ANGLE OF INCLINATION TO THE LIFTING POWER OF SURFACES WHEN MOVING IN AIR.

"I have brought to a close the portion of the work which seemed to be specially mine, the demonstration of the practicability of mechanical flight.

"The great universal highway overhead is now soon to be opened."

—Langley, 1901.

Notes for Inventors

Stops Talking Machine Automatically.—Wilford G. Altenburgh of National City, California, has secured a patent, No. 1,006,517, for a talking machine which has a catch adjustable radially upon the record disk and an inclined member on the reproducer which inclined part interlocks with the catch on the disk in such manner as to raise the reproducer and stop the disk.

Rolls Cigarettes by Hand.—A device for use in making cigarettes by hand has been patented to Leigh Lawrence Finch of New York City, No. 1,006,541. The device consists of a flexible sheet of proper size and composed of small cylindrical rods flexibly connected by fine cords passing around the rods, the cigarette being rolled in the sheet so formed.

Valves and Process of Fitting Same.—Patent to Edgar Ackerman Kelsey, Mt. Vernon, N. Y., assignor of one-half to Walter L. Abate of New York City, is for fitting valves to their seats by pressing one upon the other so that the imperfections in the shape of each will be reversely reproduced in the other, and guiding the valve to seat it in the same position in the seat in which it was fitted.

An Improved Railroad Track Curve.—Patent No. 1,006,579 has been granted John W. McManama of Waltham, Mass., inventor for an invention to minimize frictional resistance to side slip of wheels on the inner rail of a curve. In doing this the inventor makes the tread face of the inner rail narrower than that of the outer rail, the web and the base of the inner rail being respectively correspondingly thickened and widened.

A Canal Excavating and Cleaning Apparatus Needed.—Millions of dollars are being spent in irrigation projects many of which necessarily include the construction and care of so-called canals or irrigation ditches. We are told there is need of an apparatus for excavating and cleaning drainage canals. The apparatus should be adjustable to conform to uneven contours and irregularities in the land and for various sizes (as to width and depth) of the ditches and should be constructed to put the "spoil" evenly on both banks. The canals fill in some instances rapidly with silt and the cleaning could doubtless be satisfactorily effected with an apparatus capable of the original excavation.

A Flexible Arm Casing and Mitten.—In submarine work it is sometimes desirable for the operator working in a chamber to manipulate tools and parts outside of such chamber. Charles Williamson of Norfolk, Virginia, in a patent, No. 1,010,558, provides a flexible tubular member for the arm of the worker, and a hand portion communicating with the flexible member and made with flexible thumb and finger portions.

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

TAPE MEASURE.—J. KLEIN, care of Crown Novelty Works,, 174 E. Houston Street, New York, N. Y. This invention provides a measure more especially designed for use of tailors and others for conveniently obtaining the length from the crotch to the lower end of the legs when taking the measure for a pair of trousers, and to permit of readily and accurately obtaining the measure of the scye and other parts.

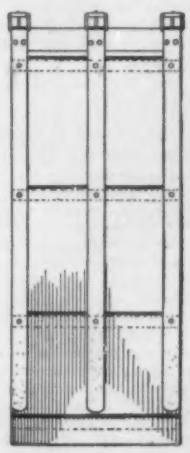
GARMENT.—M. L. KELLEY, 159 W. 92nd Street, New York, N. Y. The object of the inventor is to provide a simple and durable garment which is adapted for wear by both men and women, which can be readily converted from one style to another by a simple manipulation of the collar, and which is adapted for use with different types of garments.

Electrical Devices.

THERMOSTAT.—J. D. GOULD, 100 William Street, New York, N. Y. The present invention's object is to provide a thermostat employing the thermostatic cable or similar cable, and having metal terminals confining the opposite ends of the cable, whereby the same will not be exposed and injured by moisture, and will prevent escape of the fusible metal when expanded and melted, so that the latter will positively operate to close the current, either at the ends or along the length of the cable.

Of Interest to Farmers.

DRAPER CANVAS.—J. I. WEBER, 106 Van Buren Avenue, Moscow, Idaho. The engraving illustrating this invention shows a plan view of the improvement. In the use of the ordinary draper, straw or grain stalks are very liable to become caught between transverse slats and the canvas, thus choking the elevator and increasing the draft. There is great liability of breakage, and the machine must be stopped until the straw can be pulled out. In the present invention the inventor provides a draper canvas for use in harvesting machines for conveying the cut grain, especially designed to prevent any catching of the stalks in the draper, with a consequent increase of draft and liability to breakage.



DRAPER CANVAS.

DRAFT ATTACHMENT FOR HARROWS.—J. H. SHERARD, Sherard, Miss. This invention relates particularly to a draft attachment for harrows, and is a division of Mr. Sherard's application, Serial No. 489,777, filed by him. An object is to provide an attachment whereby the pull of either a tall or short draft animal will maintain the teeth of the harrow evenly in the ground without causing it to jump in and out.

COMPOUND LAND ROLLER.—W. WRIGHT, R. F. D. No. 1, Box 35, Blackwell, Okla. The object of the inventor is to provide a compound land roller, so constructed and arranged that it may be used in rolling flat surfaces and also for rolling in furrows, and further, for rolling the land between rows of sprouting grain. This compound sectional land roller operates at each side of the row of grain, without liability to the grain.

SEED PLANTER.—W. D. HEFLIN, Sardis, Miss. This invention is an improvement in seed-planters in which slidable seed-dischargers are operated by gear connections with a wheel that travels on the ground and serves also as one of the supports of the machine. The invention relates mainly to the construction, arrangement, and combination of the parts constituting the seed-discharge mechanism.

Of General Interest.

SMELTER SMOKE WASHER.—W. G. BULGIN, Franklin, N. C. In this case the invention relates to a new and improved device for

washing the smoke from smelting, roasting, blast furnaces and the like, in order to remove the particles of ore and dust carried over, and also to cleanse the smoke and remove poisonous fumes and gases.

SWAGE.—C. P. A. RASMUSSEN and F. M. TAGGARTT, Box 174, Taft, Cal. An object here is to provide a device for use in driven wells, to expand the casing of the same. For this purpose use is made of a tapered body having ball bearings thereon, to reduce any friction between the body and the casing when the swage is forced into the casing, and also to permit of more easily forcing the swage into the casing.

CULVERT.—O. E. DEPPEN, Box 399, Chattanooga, Tenn. The object here is to provide vitrified clay culverts with means by which they may be quickly and cheaply held relatively to one another, thereby doing away with the necessity of cutting "bell holes" in the bottom of the treach for receiving the bells and other members now used for uniting culvert members.

FLOW REGULATOR AND SEED TRAP FOR IRRIGATING DITCHES.—M. T. OTIS, Hagerman, Idaho. In the present patent the invention is an improved means for regulating the flow of water in irrigating ditches so that it is practically uniform, and also for preventing seeds of grass or weeds floating along the water and thus out upon the land.

SPOT LIGHT SONG AND LECTURE LANTERN SLIDE.—F. A. APFELBAUM, care of Levi & Co., 1560 Broadway, New York, N. Y. This invention provides a lantern slide in connection with illustrated songs and lectures, having a clear space therein to form an illuminating area for the disclosure of the entertainer; and provides in a lantern slide a clear area within the field of the photograph to form a spot light for the illumination of the entertainer.

MOLD FOR ARTIFICIAL ICE.—E. N. BREITUNG, care of Breitung & Co., Ltd., 11 Pine St., New York, N. Y. The improvement has reference to ice molds, the more particular purpose being to provide a mold having double walls and so shaped that when ice is formed within the mold, it may be readily loosened, and thus removed, by pouring hot water into a predetermined part of the mold.

ADVERTISING MEDIUM.—G. T. FIELDING, Jr., 575 Pelham Ave., Bronx, New York, N. Y. In this case the object of the invention is the provision of a new and improved advertising medium for use in show windows of stores and other places, and arranged to display a representation of the merchandise to be advertised in a very attractive manner.

DAM.—J. F. GREATHEAD, 170 W. 97th St., New York, N. Y. The invention relates to concrete structures and its purpose is to provide a new and improved dam arranged to utilize the passive pressure of the ground to hold the dam in position against the pressure and to prevent seepage of the water underneath the bottom of the dam.

FRUIT PACKING STAND.—A. B. HUMPHREY, Mayhews, Cal. The particular object here is to provide a stand occupying but little floor space, and having a packing table within convenient reach of the packer, and having, adjacent to the table, a shelf to receive the crate which has been packed, and further, to provide suitable shelves to support within convenient reach of the packer the baskets in which grapes are placed, and the cleats used in separating the tiers of baskets in the crates.

ENVELOP.—E. LOW, Refugio, Texas. This invention relates to envelops for filing documents and the like, and relates more particularly to a device comprising a back, and a closing flap having means whereby it can be held closed in a plurality of positions relative to the envelop, so that the envelop is capable of adjustment to different sizes.

Hardware and Tools.

SPLICING TOOL.—J. SCHUTTEE, Silver Springs, N. Y. The purpose here is to provide a tool used in splicing or weaving together the strands of hempenrope or a steel cable, which is of improved construction, whereby one hand only is necessary to the operation of the device, the other being left to hold the rope or cable in the most convenient position during the splicing or weaving.

PENCIL HOLDER.—J. Q. MOXLEY, Lewiston, Idaho; J. H. ROBINSON, inventor. The purpose here is to provide a construction including a body portion having guides receiving the pencil and a clamp operating upon the pencil between the guides in such manner as to lock the pencil against accidental longitudinal movement so that it will not be displaced and lost, the device being adapted to thus serve as a pencil holder and being made so that it will serve as an ornamental pendant in the use of the invention.

Heating and Lighting.

ELECTRIC GAS LIGHTER.—H. D. GRINNELL, Agricultural National Bank Building, Pittsfield, Mass. This lighter is for use on motor vehicle lamps and other lamps, and has the sparking electrodes so placed that the spark ignites the diffused gas issuing from the burner, without the spark being subjected to the gas pressure and without the points of the sparking electrodes being within the flame or subjected to the intense heat thereof.

APPARATUS FOR HEATING LARGE BODIES OF AIR.—J. HAGEMEISTER, Ostervej 5, Vordingborg, Denmark. This invention concerns an apparatus for the heating of large bodies of air, for the purpose of obtaining large pressure, and transmitting the pressure into effective work. The invention can be made use of in all such places where it is of importance to heat large bodies of air and transmit them at high speed or subject them to large pressure.

RANGE WARMING CLOSET.—M. F. ALLEN, care of Allen Mfg. Co., Nashville, Tenn. The object here is to provide a closet disposed in the rear of a wall member connected with the range, it being possible to reach the closet through an opening in the wall member. The last is adapted to be disposed against the wall of a room with the flue from the range at the side of the closet and in the rear of the wall member.

FURNACE ATTACHMENT.—A. SAUER, care of Sauer Power Generating Company, 5115 Rosette Street, Pittsburgh, Pa. This invention relates to blast furnaces, smelting ovens and like apparatus, and its object is to provide an attachment whereby the gases are rapidly drawn from the stack of the furnace and utilized to heat feed water for boiler or other apparatus and to finally condense the gases to render the same harmless.

LAMP SHADE HOLDER.—J. CRUIKSHANK, Shamokin, Pa. This invention relates more particularly to a holder for use in connection with incandescent electric light. All screws are eliminated. The device is preferably formed of a tubular body of sheet metal, cut and stamped to desired form, an operating plate and a plurality of gripping members, brought into or out of position by the movement of the plate of the tubular body.

GRATE BAR.—J. H. DUNAVON, General Delivery, Pueblo, Colo. This invention is an improvement in grate bars adapted for use in locomotive or other coal burning engines or boilers, or furnaces where grates are desired; and the object is to provide a novel construction whereby the supply of air or oxygen to the fire can be increased to secure a better combustion.

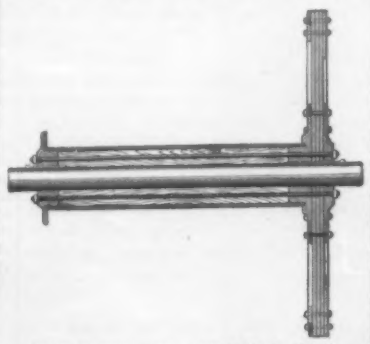
INVERTED INCANDESCENT GAS LAMPS.—G. LENTSCHAT, Schmargendorf, Berlin, Germany. This invention consists of a very cheap burner tube suitable for inverted incandescent lamps and adapted to support a chimney or globe without any danger of cracks. The chimney or globe expands under action of the heat of the light and contracts when cooling, thus avoiding all danger of fracture due to change of temperature.

BURNER.—G. G. MELHART, 126 North Pickering Avenue, Whittier, Cal. The object here is to provide a burner more especially designed for use in kitchen stoves, ranges, and the like, for burning liquid fuel such as crude oil, and arranged to readily atomize the liquid fuel and to thoroughly mix the same with air to insure complete combustion of the liquid fuel and to produce an intense flame and heat without danger of the parts becoming clogged.

LAMP SHADE HOLDER.—H. H. PALMER, assignor to F. E. Palmer, St. Denis Hotel, New York, N. Y. This invention relates to lamp shade holders, and it has for its object to provide a simple, cheap, and readily operable device for firmly holding a lamp shade in position on a lamp socket. A lamp socket is provided having depending annular fingers around its periphery, the lower portions of the fingers being adapted to be disposed beneath a collar on the shade.

Machines and Mechanical Devices.

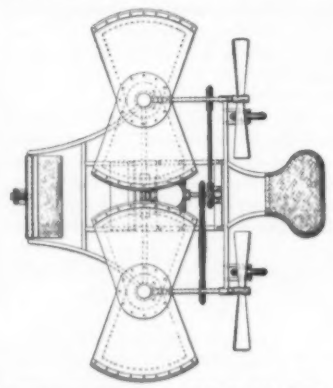
CALF WHEEL REEL.—T. A. BEECHER, Coalinga, Cal. This invention provides a wheel and shaft for use in raising and lowering casings in artesian and oil wheels, and further, to keep the casing loose. For this purpose it provides a casing mounted to inclose a centrally-disposed shaft with a filling of material such as sand or cement, in the



CALF WHEEL REEL, SECTIONAL VIEW.

casing between the inner surface of the casing and the shaft, a flanged wheel secured to one end of said casing with the shaft extending through the wheel, a toothed wheel secured to the said wheel, and a circular flange secured to the other end of the said casing and connected with the said wheel by a plurality of bolts extending longitudinally through the casing. The engraving represents a longitudinal sectional view of the reel.

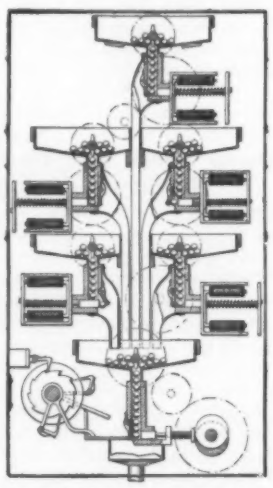
REVOLVING PLANE.—JAMES HAYTON, Box 358, Salt Lake City, Utah. This invention relates to revolving planes for flying machines, to take the place of the stationary planes now used therein. The revolving planes permit a more perfect supporting surface, and take up less space and have a higher factor



REVOLVING PLANE FOR FLYING MACHINE.

of safety than the stationary supporting planes now in use in ordinary flying machines. The machine entire occupies only one-half as much space as other flying apparatus. It cuts its way through the air by means of the revolving planes, and the weight of the device falling through the atmosphere makes the planes revolve and thus retards fast falling and keeps the machine in perfect balance while descending to the ground. The invention is shown in a top plan view in the accompanying engraving.

AUTOMATIC CENTRALIZING TOTALIZER APPARATUS.—ETIENNE POTET, 1517 Michigan Avenue, Chicago, Ill. Among the principle objects which the present patent has in view are: to provide a mechanism adapted to be operated electrically from removed stations to total the results of a plurality of cash registers; to provide a mechanism continuously operated and having a plurality of selective devices arranged in groups corresponding to the series of the various monetary denominations to operate in the series; and to provide a mechanism, the construction and arrangement of the parts of which are durable, accurate and efficient. In the accompanying engraving will be viewed the front elevation of the apparatus, the casing having been removed.



AUTOMATIC CENTRALIZING TOTALIZER APPARATUS.

PUMP.—W. L. HAMILTON, Bangor, Mich. In the present patent the invention has reference to a new and improved pump of a type adapted to force any fluid, such as water or air, and further, of a type which will automatically regulate its own pressure without the need of extraneous relief valves.

DRAIN VALVE.—W. C. HAMMOND, care of National Iron Works, Spokane, Wash. The object here is to so place and construct this drain valve that its operation will not be interfered with by the presence of sand and sediment, the substance of which entering the drain valves previously in use chokes them and renders them inoperative.

SHUTTLE FOR WEAVING LOOMS.—M. LEMARCHAND, R. LEMARCHAND, and V. MONTET, 83 Boulevard Cauchase, Rouen, France. The invention consists in arranging in the shuttle an opening capable of freely receiving a feeling finger arranged in front of the lay and of combining with this shuttle a stopping device normally held away from the opening by the thread wound around the bobbin and placed automatically in the opening opposite the finger, when the thread fails, in order to actuate the finger. The shuttle plays with regard to this finger the same part as a jacquard card with relation to the needles by means of its holes and full parts.

PLAYER PIANO PEDAL.—W. BEDFORD and R. K. THUMLER, Fifth Avenue and 142nd Street, New York, N. Y. This invention comprehends a pair of pedals mounted to swing in and out through a doorway with which the piano casing is provided, the pedals being particularly supported at points located within the casing by aid of a pair of rods bent into peculiar shape and so located relatively to the doorway that when the door is being closed the pedals easily pass through; whereas, when the door is open and in lowermost position, the pedals extend outwardly through the doorway and while in use reach farther than the door.

CAM INDEXING DEVICE.—C. G. LUNDGREN, 2438 Jackson Boulevard, Chicago, Ill. This invention comprehends an attachment for a lather milling machine or grinding machine adapted to carry a smooth cam shaft, i. e., one not provided with a keyway, and upon which one or more cams are surmounted that may be readily turned, milled, ground or otherwise dressed or machined by aid of the rotation of the shaft upon which the cams are mounted.

ABRADANT ATTACHMENT.—G. O. BEASLEY, Weed, Siskiyou County, Cal. The present invention relates to grinding and polishing and has for an object to provide an attachment for machines and adapted for grinding or polishing, the driving power being derived from the machine to which the device is attached. It relates more particularly to a device for attachment to sewing machines and consists in various improvements over a sewing machine attachment for which U. S. Letters Patent No. 962,731 were granted to Mr. Beasley.

BALANCING MEANS FOR AEROPLANES.—H. F. PARKER, 794 Washington St., Dorchester Center, Mass. Mr. Parker's invention relates generally to aeroplanes, and more particularly is directed to an improved balancing means whereby the machine may at all times retain its horizontal position, the same means being operable by the aviation to effect changes in the direction of flight of the machine when in the air.

DYEING MACHINE.—J. LEISEL, care of Leisel Dyeing Machine Co., Box 569, Charlotte, N. C. This machine dyes either loose material or jams wound on a beam, and has a circulating system for circulating dye liquor or clear water through the vat and material therein, and there is an overhead mechanism for manipulating the perforated vat cover and the false bottom, between which the material is laid, the system having a pump adapted to be driven by a reversible motor, which is also used for actuating the said mechanism in either direction.

LEVER FOR PIANOLAS AND LIKE INSTRUMENTS.—W. GERVAIS, Lieut.-Colonel of Russian Army, St. Petersburg, Russia. The striking levers of existing types of pianolas and like mechanical instruments, represent crude systems which cannot give the strokes of the keys that special touch which is peculiar to the human hand. This drawback, notwithstanding all the improvements, cannot place pianolas and the like instruments on a level with the technical art of a human being. The invention avoids this drawback almost entirely.

Pertaining to Vehicles.

DRIVING AND STEERING MECHANISM FOR MOTOR VEHICLES.—W. H. DOUGLAS, Belleville, N. J., assignor to Healey & Co., 1652 Broadway, New York, N. Y. The aim of this invention is to provide a mechanism for automobiles and other motor vehicles arranged in the plane of the wheel, to reduce twisting strains to a minimum, to insure easy running of the wheel, and to render the driving connection between the driven axle and the wheel exceedingly simple and durable in construction.

FRICTION GEARING.—L. N. LACOMBE, 337 Fifty-sixth Street, Brooklyn, N. Y. The object of the invention is to provide a new and improved friction gearing, more especially designed for use on automobiles and other motor vehicles, and arranged to permit a gradual change from a low speed to a high speed and *vice versa*, and to provide a wholly friction drive from the motor shaft and shiftable driving pinion that engages the driven wheel.

Designs.

DESIGN FOR A DOLL.—D. ROSENTHAL, 512 Broadway, New York, N. Y. In this ornamental design for a doll the figure represents a small boy in a long jacket and in trousers, with his left arm extended upwardly and the other dropping at the side. Mr. Rosenthal has designed another figure, that of a girl doll of the same characteristic pose as executed in the first named design. Her dress is cross-striped material, with belt and cuffs ornamented in **X**'s.

DESIGN FOR A LACE PANEL.—J. HEROD, assignor to Patchogue Manufacturing Co., 141 Fifth Ave., New York, N. Y. This lace panel design comprises a panel with massive draped curtain effect at the top and the sides. The field is white and in the middle of this is a scroll bordered design with three doves, two perched at the bottom and one in flight above them.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

FOODS AND THEIR ADULTERATION. By Harvey W. Wiley, Ph.D. Philadelphia; P. Blakiston's Son & Co. 8vo.; 641 pp.; 11 colored plates; 87 illustrations. Price, $4 net.

As one of the most-talked-of men in the country. Dr. Wiley needs no introduction. Written primarily for the benefit of the public, "Foods and Their Adulteration" will be appreciated by scientists, physicians, and foodstuff manufacturers and dealers, as a dispensary of information with which they are deeply concerned. Dr. Wiley has laid stress upon the fact that suitable feeding and proper nutrition will do wonders in warding off disease, and even in enabling the body to throw off disease after it has once been acquired. The general headings under which the subject is handled are: "The Origin, Manufacture, and Composition of Food Products; Infants' and Invalids' Foods; the Detection of Common Adulterations; and Food Standards." The present issue is a revised second edition, enlarged by a hundred pages. The article on infants' and invalids' foods constitutes the most important addition, and describes their preparation and care. The vital necessity of the natural supply of milk for infants is insisted upon, and there follows a consideration of the substitution of fresh cow's milk, modified to resemble closely the natural sustenance of the infant. Fads and extremes have been avoided. The suggestions are kept well within the bounds of common sense and the information is based upon ascertained facts. The Food and Drugs Act has done much to benefit the people and protect their health and their rights, but the extension and continuance of such benefits depends upon educating the people up to the point of knowing their own rights and needs, and insisting upon having them properly supplied. Such works as this of Dr. Wiley's are necessary to the inculcation of a saving knowledge.

INDIAN TRIBES OF THE LOWER MISSISSIPPI VALLEY AND ADJACENT COAST OF THE GULF OF MEXICO. By John R. Swanton. Washington: Government Printing Office, 1911. 8vo.; 387 pp.; illustrated.

It would be hard to find a region of greater interest to ethnologist and archeologist than that covered by Bulletin 43. To the former it presents a linguistic complexity worthy of the closest study; the latter finds a rich field for his explorations, situated between the mound culture of the Mississippi and Ohio valleys and the cultures of Mexico and Yucatan. One tribe within this region is of such high social organization that it is regarded as a remnant of mound-building culture. Among the tribes classified and studied are the Natchez group, the Muskhogean tribes proper, and the Tunican and Atakapa groups. The life, costumes, and customs are dealt with at length, and some very good plates show the perfection to which basketry has been brought. Other plates picture physiological types, views of the country, methods of torture and mortuary rites. A folding map gives the physical and social divisions of the district, its coloration indicating the linguistic positions of families and tribes.

ROME. A Practical Guide to Rome and Its Environs. By Eustace Reynolds-Ball, B.A., F.R.S. London: Adams & Charles Black. New York: Macmillan & Co 16mo. Price, $1.10 net.

There is perhaps no city in Europe which exercises so potent a charm on all classes of visitors as does Rome. It may be partly due to its historic traditions, memories and associations, in which no city in the world is so rich; or we may attribute this glamor to its wealth of art treasures, its noble churches, its streets of Renaissance palaces, and its supreme archæological and historical interest. Books about Rome are legion, and the author who is desirous of adding another to this literature should be very certain that he is able to produce a valuable handbook. Mr. Reynolds-Ball has succeeded in making a guide which is light in weight, small in size, and which is most comprehensive. The text is excellently written, and the authorities consulted most imposing. The climate and medical hints, if attended to, will greatly minimize the dangers of illness in Rome, stories of which are very much exaggerated. The illustrations, many of which are in color, are extremely beautiful. There is an excellent folding map of Rome on a good scale.

BIRD FLIGHT AS THE BASIS OF AVIATION. By Otto Lilienthal. London: Longmans, Green & Co., 1911. 142 pp.; 94 illustrations and 8 lithographed plates.

To review Otto Lilienthal's classic book, which for twenty years has served as the basis of experiment on the part of many inventors, is quite unnecessary. That work has already taken its place as a literary monument to its author. Only too long has it been inaccessible to English readers, for which reason this translation from the second edition is to be welcomed. Although time and the experience of aviators have perhaps disproved some of the great Otto Lilienthal's contentions, in the main the work still stands as a safe, sane, and clear exposition of the principles that underlie dynamic flight. Mr. Lilienthal's brother Gustav supplies an eloquently-worded preface in which he points out the debt of the modern aviator to the early gliding experiments made at Rhinow.

CENTRIFUGAL PUMPS. Their Design and Construction. By Louis C. Loewenstein, E.E., Ph.D., and Clarence P. Crissey, M.E. New York: D. Van Nostrand Company, 1911. 8vo.; 435 pp.; 320 illustrations, 8 folding plates. Price, $4.50 net.

Ten years ago the centrifugal pump was seldom employed save in large capacities and low heads. Now rotating machinery is offering very serious competition to reciprocating machinery, and the centrifugal pump, lower in first cost, requiring little space, and simpler in installment and operation, is built by all the larger manufacturers for all manner of services. A lack of exhaustive and satisfactory works on the subject leads the authors to put out this volume, and they have succeeded in compiling a work of value and appeal. The theory of the centrifugal pump is set forth at length; the design and necessary calculations are plainly and thoroughly reviewed; and some two hundred pages of text and illustration are devoted to the various types, their details of construction, methods of operation, and efficiency. The final chapter gives the four approved ways of testing—the Venturi water meter, the Weir tank, the nozzle, and the Pitot tube.

GEOLOGY. By J. W. Gregory, F.R.S. 12mo.; illustrated. New York: D. Appleton & Co., 1910.

CHEMISTRY. By W. A. Tilden, D.Sc., F.R.S. New York: D. Appleton & Co., 1910. 12mo.; illustrated.

BIOLOGY. By R. J. Harvey Gibson, M.A. New York: D. Appleton & Co., 1910. 12mo.; illustrated.

BOTANY. By J. Reynolds Green, Sc.D., F.R.S. New York: D. Appleton & Co., 1910. 12mo.; illustrated.

These four little text books, each written by a man prominent in his field, will serve to give the general reader a simple outline of the respective sciences. Prof. Gregory, in the short introduction to Geology, has explained some important geological principles which are often omitted from works of this size, and has given more space to the materials of the earth than to the geographical processes that affect them.

Prof. Tilden has laid down clearly the ideas of the nature of the processes of chemical combinations and decomposition and of the conditions under which chemical action takes place. Facts alone are relied upon throughout the early part of the book, and no theory has been introduced except after due preparation.

In his excellent little book on Biology, Prof. Gibson has given an outline of the modern physico-chemical conception of biological processes. In a book such as this, the difficult problem which confronts the author is what to leave out, and the highest compliment that can be paid to Prof. Gibson is to say that he has shown good judgment in that respect.

In the little book on Botany, Prof. Green has treated botany from the biological standpoint, and has presented plants as they are engaged in the struggle for existence. Hence the reader's attention is called not only to their form and structure, but especially to what they do in life and why and how they do it.

HOME WATERWORKS. A Manual of Water Supply in Country Homes. By Carleton J. Lynde, Professor of Physics in MacDonald College, Quebec. New York: Sturgis & Walton Company, Cloth; 5 by 7½ inches; pp. 270; 106 text figures. Price, 75 cents, net.

If we have any criticism to make of this book, it is the fact that it contains too much irrelevant matter. Plumbing and sewage disposal, cesspools, and discussions of sanitary problems, however brief, hardly find a place in such a book. Not all of the statements made on the subject of sanitation can be commended. Whatever the author may believe, the septic tank is not generally to be recommended. Despite these faults, the author has performed a really useful service in giving the general reader, without too much technical verbiage, a good idea of the various kinds of water supply systems which are available for country use. He has also given descriptions of the methods in which much of the apparatus described operates, which, although not strictly necessary, is nevertheless good, because only too few householders know anything of the physical principles that are involved in the construction and operation of water supply systems.

AN INTRODUCTORY PSYCHOLOGY. By Melbourne Stuart Read, Ph.D. New York: Ginn & Co., 1911. 12mo.; 309 pp.; illustrated.

"An Introductory Psychology" is written in a popular rather than a technical terminology, so that any reader of ordinary intelligence may understand its teachings without first mastering a new vocabulary. After explanations of the general nature of consciousness and of the nervous system, the author deals with the various processes of adaptation, sense stimulation, the modes governing affection and feeling, attention and interest, memory, imagination, emotion, and the will. For those who desire some primary knowledge of the human mind and its mechanism, this text-book will serve to initiate them into the first mysteries of a fascinating and comparatively new science. It will aid them toward a more intelligent direction of mental effort, and it imparts a knowledge that should be universal.

PAPER-BAG COOKERY. By Nicholas Soyer. New York: Sturgis & Walton Company, 1911. Cloth, 16mo. Price, 60 cents, net.

M. Soyer, chef of the Brook Club, advocates in this book the use of special paper bags in place of pots and pans for cooking. He gives recipes and complete instructions which can easily be followed. We have given the method advocated an extensive trial, and have found that there is indeed much saving of "pot-wrestling." Our own experience bears out M. Soyer's contentions that the dishes are more savory and nutritious, that his method is more economical than the old, and that paper-bag cooking is hygienic.

DER MASCHINEN- UND VOGELFLUG. Von Josef Popper-Lynkeus. Berlin W.: M. Krayn, 1911. 103 pp.

If the reader of newspapers believes that the air has really been conquered, and that we have nothing more to learn from the bird, he would do well to read this book. Eagles and condors fly with an expenditure of horse-power which has been estimated at 0.05. Yet the modern flying machine uses up anywhere from 25 to 100 horse-power. In this book the author has discussed the bird as a machine. He presents a novel method of estimating the work performed by a bird in flight, which differs in its results from the commonly accepted figures. The author has ignored modern investigations of air resistance because, in his estimation, they can be regarded only as tentative, and therefore not amenable to expression as yet in a definite form of laws. Whether he has acted wisely in doing so we doubt, although we are not prepared to say that his results are wrong. The whole phase of the subject is still shrouded in so much mystery that any competent writer on aviation is justified in pursuing his own course. The author has performed good work in placing Alphonse Penaud where he belongs, for Penaud was an investigator of whom we hear too little. Langley was one of the few men who realized the value of Penaud's work. Indeed, the author goes so far as to call him the father of modern aviation, although that, we believe, is rather extravagant.

PLAYGROUND TECHNIQUE AND PLAYCRAFT. Vol. I. By Arthur Leland and Lorna Higbee Leland. New York: Baker & Taylor Company, 1910. 8vo.; 284 pp.; illustrated. Price, $2.50 net.

The schoolroom inculcates obedience under pain of punishment; but the playground instills discipline, fortitude, and honor for the benefit of the one and the many. It teaches, more forcibly than does the school-room, the lesson of our interdependence, and the necessity of sharing pleasure in order to enjoy it. Its activities clear the brain, upbuild the vital powers and the physique, and establish the outdoor habit. At the same time the brain is assimilating rules, grasping intricate situations, and learning to take quick advantage of these situations. "Playground Technique and Playcraft" is a very thorough study of the philosophy of play in its practical applications, and of the lay-out and equipment of the ideal playground. It emphasizes the adaptability of the child, through play, to the world of nature and material things. It is rich in suggestion to all child enthusiasts. A second volume still further develops the idea of manual training, through which the children are taught to make their own playthings, and includes also playground administration, supervision, and operation.

ALLGEMEINE VERERBUNGSLEHRE. Von Valentin Haecker. Braunschweig: Friedr. Vieweg & Son, 1911. 392 pp.; 139 illustrations.

This book was evolved from a lecture course delivered in recent years at the Technical High School at Stuttgart and the Agricultural High School at Hohenheim. As the work now stands, its object is to present in a readily understandable form the biological conception of heredity. In the last twenty-five years the study of heredity has been made a specialty, so much so that a book in which the historical development of that particular field of research is treated is really necessary. The author has endeavored to trace this historical development and to link together modern teachings, so far as they affect not simply zoölogy, but also botany, morphology, physiology, and microscopy as well. He has also considered the practical application of the laws of heredity to human beings, domestic animals, and plants. A good bibliography will enable the thoughtful student to pursue the subjects discussed more in detail.

THE MAKING OF A MECHANICAL OPTICIAN. By W. W. Slade. Philadelphia: The Keystone Publishing Company, 1911. 4to.; 188 pp.; illustrated. Price, $1.00.

The writer starts with the selection, installation, and operation of the machinery necessary to enable the optician to do his own work, and passes on to instruction in the various mechanical operations—the marking and cutting of lenses, the marking of prisms, and lens grinding, drilling, and mounting. Soldering and repair work is given a due share of attention, and throughout the book cuts and diagrams are unsparingly employed to interpret quickly and accurately the meaning of the writer. For the optician considering the advisability of installing his own plant the instructions will be of the greatest value.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12589) C. O. H. asks: Is it possible and practical to eliminate the objectionable buzzing and sputtering of an electric arc as used in a projection lantern? I refer to the spasmodic sputtering and hissing as distinct from the musical note corresponding to the frequency of an alternating current service. A. The direct-current arc in a projecting lantern burns as quietly as a tallow dip when properly adjusted. If it hisses it is too short for the current, and the positive carbon must be drawn back or the resistance must be increased in the rheostat. The size of the carbons must be also considered. If a small carbon is used, less current must be turned upon it. A. Half-inch carbon will take 15 to 20 amperes and a ⅝-carbon will carry 25 amperes quietly.

(12590) C. A. H. writes: In the SCIENTIFIC AMERICAN of December 16th, 1911, F. L. Y. asks, "How high does a person have to go before the earth becomes invisible to the sight?" The answer given is that it would be just visible at such distance that it subtends one minute of arc, namely, 27,000,000 miles. The answer seems incorrect to me, for the following reasons: Mars, at its closest approach to the earth, is about 33,000,000 miles distant, and is very brilliant, rivaling Jupiter. Even at the present time, although Mars is not at its closest, any one can see how very brilliant it really is. But Mars is only 5,000 miles in diameter, and at its closest approach to earth and sun is about 1/3 farther from the sun than the earth is. The disk of Mars, in other words, is only $(5/8)^2$ as big as that of the earth at the same distance, and the intensity of light received by Mars from the sun is only $(3/4)^2$ as great as that received by the earth. Hence the earth probably seems $(4/3)^2 \times (8/5)^2$ or roughly 4 times as bright (except for difference in phase) to the Martians, if such there be, as Mars does to us. Perhaps F. L. Y.'s question can be answered in another way. The planet Uranus is about 4 times the diameter of the earth (16 times the disk at the same distance) and is roughly 1,750,000,000 miles from the sun, that is, about 18 times as far from the sun as we are. It therefore receives $(1/18)^2 \times 16$ times as much light from the sun as we do, that is, about 1/20 as much. Yet Uranus is just visible about as a sixth magnitude star from the earth, so conversely, the earth as seen from Uranus seems 20 times as bright as Uranus seen from the earth. Therefore, the limit of visibility would be $\sqrt{20}$ times the distance of the earth from Uranus, namely, 7,500,000,000 miles. (I have assumed that the planets are of equal reflecting power per unit of area.) A. You understand the question, "How far can the earth be seen?" in a different way from what we understand it. We take it to mean, how far can the earth itself be seen, that is as a disk, and not how far can the light reflected from the earth be seen? This last is the question which you have endeavored to answer. You may arrive at a very reasonable result; but the result depends upon the assumption, as you state in closing, that the reflecting power of the earth as a whole, its albedo, is the same as that of the planets. This is the point about which we have no definite knowledge, nor can we obtain any exact determination. Some work has been done upon this question which may be extended in the future. It was reported in the SCIENTIFIC AMERICAN, Vol. 105, No. 4, on page 74, price 10 cents. The albedo of the earth's surface was measured from a balloon at altitudes varying from 2,000 feet to more than a mile. The results were for open fields, 0.105, and for woods 0.06. These numbers are far below the lowest of other planets. The albedo of the planets differs greatly. This is expressed in the fractional part of the sun's light which the planet reflects. They are given in Todd's "New Astronomy," page 332, as follows: "The moon's surface reflects about 1/6 the light falling upon it from the sun. The albedo of Mercury is even less, or 1/8; but the surface of Venus is highly reflective, its albedo being 1/2. The albedo of Mars is about 1/4; that of Saturn and Neptune about the same as Venus, 1/2; while the albedo of Jupiter and Uranus is the highest of all the planets, or nearly 2/3. These figures are practically those of Zollner. Where would the earth come in on this rating? We think it will be apparent that no definite comparison of the distance to which the light reflected by the earth can be seen is possible with that at which any of the other planets can be seen. The distance at which its disk vanishes is as we gave it. That can be definitely calculated. For that reason we gave our answer before as we did, but we shall be glad to place the other view before our readers.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Technique of Clam Digging

To the Editor of SCIENTIFIC AMERICAN:

It is amusing, when we think we know a thing thoroughly, to find we do not know all about a given subject.

Clam digging and its technique is a simple matter, yet Mr. Johnson of Seattle has never "dug" the festive "fan" clam, and, though living in a clam country, and a city whose people certainly cannot be accused of clam natures, would probably dispute the fact that there are clams in the waters of Puget Sound that swim. The clam commonly known as the "fan" clam must be taken with a rake or can on the end of a pole as long as a rake handle out of a boat.

I have had hours of sport getting these beautiful shells with the living clam in them.

They lie on top of sandy stretches of the beach, close to or under sea weeds, and are very quick in their zigzag motions when disturbed, darting up, around, and through the water, and if the "clam hunter" is not expert and knows nothing of the habits of the "fan" clam, it is doubtful if he ever sees them, to say nothing of capturing any.

The shells are covered with a fuzzy substance which falls off after the clam is boiled, leaving thin, delicately colored, ribbed shells, the ribs radiating like the leaves of a fan—hence their name.

The most common clam and the most edible is obtained by digging, as described by Mr. Johnson.

There is yet another clam that requires a totally different technique. It is commonly called the "goeduck," but the dictionary spelling is "geoduck," which I translate "earthduck."

This clam has to be dug for in earnest, not as you would dig potatoes, but as you would dig a deep hole for a telephone pole. Its neck is stretched as much as six feet, and its shells are as large as a man's hand. The body protrudes, so that the shell on either side cannot meet opposite the hinge.

This clam is often dug out of clay banks along the edges of the Sound, and again at the very lowest tides it can be found deep down below the surface.

I have found five distinct "species" of clams in quantities in Puget Sound, and do not pretend to be well acquainted with the clam family. GEORGE LAWLER.

Tacoma, Wash.

Are There Any Holes in the Air?

To the Editor of SCIENTIFIC AMERICAN:

The numerous fatal accidents which have occurred in aeroplane work, and which have involved the most skillful navigators of the air lead one to look for some cause which is not allowed for or fully appreciated. We hear of "holes in the air" and such expressions, which are very indefinite and more or less illogical. In thinking over this matter, it appears to the writer that the fatal conditions are substantially two, and they are conditions which may overtake the most skillful and leave him entirely unprepared and entirely helpless. One of these is the "following gust" and the other is the "slackening head wind." Let an aviator be flying in comparatively still air in which his speed of progress with respect to the air around him is say thirty miles an hour; now let the air back of him, as a "following gust," suddenly increase to a speed equaling his own, and let this increase take place in a period of time which is too short for his machine to accelerate, or let the increase be of such a character that in spite of what little acceleration he gains, the "following gust" overtakes him and leaves him in still air relatively to the machine; that is, the machine and the air in which he is immersed are moving forward at the same rate. At this moment all control apparatus fail; vertical rudders, horizontal rudders, ailerons, everything, even the main planes, fail to have an effect, and the aeroplane is just like a kite in the air with the string cut, liable to plunge in any direction to earth, without the possibility of help or assistance from any of the devices provided. Fortunate the aviator is if, before the aeroplane is much disturbed, the conditions change so that he has a speed relative to the air. This may save him; but if the conditions occur to a degree or for a time which prevent his righting himself, a confused action of the machine and a fall is inevitable.

The other dangerous condition is that of a head wind which is holding the aviator back, and which head wind suddenly has a flaw, or ceases; instead of being an acceleration of wind back of him, it is a retardation of the wind velocity ahead of him. This, again, will leave him with insufficient forward motion of his machine and in a condition of instability, as in the other case, which is only to be recovered by his acceleration or by the retardation of the wind within a short period. Should the condition of his lack of relative motion with respect to the air around him, which is in both cases the secret of the trouble, exist for a time, he is helpless, and may become the victim of an accident.

It is manifest that a gustiness of the wind which strikes him sidewise is not dangerous, but sudden accelerations and retardations of the air current in the direction of his motion put him in imminent danger by depriving him of all effective means of control.

I do not know how far these actions are understood, but I have never seen them discussed as the true causes of danger and difficulty in navigation of the air by aeroplane. ELIHU THOMSON.

West Lynn, Mass.

Watching for and Preventing Forest Fires

(Concluded from page 48.)

dry punk logs and débris form the most inflammable kind of material for ignition by a spark from the engine. Furthermore, the heavy grades in the mountains require a full and forced exhaust on the engines in order that sufficient steam may be kept up. Most of the spark arresters now in use interfere with the draft and, as a result, the wire screen must be knocked out or opened up, so that the engine may get up the difficult grades. The more modern and larger locomotives have a return draft, by which the larger cinders are forced back to the fire box before being emitted through the stack.

Despite improvements, both in engines and spark arresters, the railroads still hold first place as a cause of forest fires. The second great cause of fires, and the only one which can be classed as non-preventable, is lightning. During the dry season in 1910 there were many electrical storms in the timber region and innumerable small fires were found immediately afterward. If the storm is accompanied by rain there is, of course, little or no danger, but it is more usual for these mountain electrical storms to be unaccompanied by rain. In 1909 there were reported 294 fires originating from this cause.

Over 400,000 people go to the National Forests for recreation each year. Many of these people are out for a week or two at a time to hunt, fish, or just to enjoy outdoor life in the hills. Unfortunately many of the campers either are careless or are ignorant of the proper handling of camp fires. The carelessness takes the form of leaving the fires unextinguished, or of throwing about cigar or cigarette stumps or knocking out pipes. The usual Turkish cigarette is a slow fuse that burns continuously to the end. The ignorance is shown in the failure to keep camp fires small and in not building them in fairly open places and away from punk logs and débris. Frequently a large fire is built when a little one would serve the purpose better and be safer. Everyone who has been in the hills has run across the skeletons of old tepees that mark the Indian camping grounds. The fireplace gives the impression of having been used for generations. It is simply a depression in the ground about 2 feet square, surrounded by a cleared space about 10 feet in diameter. Their fire protective methods might well be followed. The clearing of timbered lands for cultivation by settlers contributes materially to the fire danger each season. The débris must be burned and, in many cases, for lack of market, even the logs

themselves are thus disposed of, in order to clean up the land. The increasing use of donkey engines in logging has brought about a corresponding increase in fires, and logging locomotives passing through cut-over area is another source of some of the largest forest fires.

In the National Forests, of course, fire engines can not be used; but the reporting of fires, the quick calling for assistance, and the keeping in readiness of necessary tools and equipment are of much aid in preventing the spread of flames.

Modern devices are now being employed in the operation of the Forest Service. Of these the telephone is one of the most valuable. Already several thousand miles of line has been laid, with trees as poles. At intervals of a half hour or an hour's run, the ranger can reach a tree telephone and notify the nearest station of any danger. What this safeguard means, is shown by the former alarm system. Before the installation of the telephone, it was necessary for the ranger to ride to the nearest settlement, where he gathered such help and supplies as he could with the least loss of time, and returned to the fire, after sending a messenger on to headquarters to give the alarm. But, in the mean time, hours had been lost, and they meant thousands of dollars waste to the nation. In one fire, because a privately owned telephone line in the national forest was out of repair, seven million feet of timber burned in one afternoon. The forest supervisor bought that telephone line before another season opened.

In the forest reserves of Montana and other parts of the Rocky Mountains the most important duty of the ranger is to watch for fires. It is a very dry country, and the woods are like so much tinder, which a spark may ignite. The ranger, from his post of outlook on the top of a mountain that may be two miles high, locates the fires with the help of a field-glass, and "plots" them on a sketch chart of the surrounding region. Then, descending to his cabin or to some other station of communication, he telephones to other guards of the forest—it may be over distances of fifty miles or more—and gives them warning of what he has observed. Of course, they likewise have been on the watch, and by such means the entire forest is covered by a complete fire alarm system.

The telephone wires run in all directions through the forest—the instruments simply attached to trees, being so distributed that a ranger can always put himself, at brief notice, in communication with other guards, to give information or to call for help. It is a matter of no little difficulty to keep the service always in first-rate running order, for falling trees, blown down by storms, are liable at any time to dislodge or break the wires. When a fire has been located the first thing requisite is to get as many men as possible to the spot to fight it. But they must have food and other supplies, which have to be brought long distances over difficult trails. Formerly this was a very arduous matter, involving long delays, for a week might easily be consumed in transporting the provisions, etc., from the nearest source of supply to the scene of active operations; and meanwhile the fire burned on. The obstacle has been overcome to a great extent, however, by establishing, in various parts of the forest, depots which are drawn upon in any emergency.

Another means of fire warning of much importance are the watch stations, from which signals can be made. They are situated on some eminence, such as a bare mountain top or rock formation that is higher than the surrounding country, and notice of a fire is given in the day time by waving flags, or flashing the sun's rays from mirrors. The method is very similar to that of the army signal service. Some watch stations are made of wooden framework with a railed platform, possibly an inclosure at the top. From the platform an unobstructed view can be obtained.

Each forest watcher is usually provided with a marine glass as well as a signal mirror, so that in the western mountains, with the aid of the lens, he has a range of 25 to 50 miles. The watch tower is always located so as to be seen distinctly from one of the forest stations, and a ranger is continually on duty during the day to look for signals. At some of the watch towers gasoline torches are

provided for signaling if a fire should be discovered in the night.

The fire watch tower is also being constructed in the East. The Massachusetts Forest Commission has erected a series of steel framed towers in different portions of the State forests. At the top, a shelter of sheet steel is built for the watchman, the sides being of glass set in iron frames. One located at Plymouth, Massachusetts, is over 100 feet high, and the watchman has a view of 30 miles in all directions.

Curious Light Phenomena of the Indian Seas

(*Concluded from page 51.*)

The captain was especially struck by the fact that the larger spots of phosphorescence in the sea appeared to light up more brightly as the rays reached them, and to fade out in the dark intervals. When the center was right abeam the rotation was so fast that the rays passed about once a second. When the rays were no longer visible the bigger spots of phosphorescence for some time lighted up at regular intervals, as if they were still passed by the rays. Gradually this decreased, and the phosphorescence shone as usual in the bow-water and along the vessel's side. The lookout and the helmsman also observed the phenomenon.

The Danish Meteorological Institute has collected a few reports of other observations somewhat similar to the above. A similar case was reported in the *Annalen der Hydrographie und maritimen Meteorologie*, 1899, p. 483, as follows: On November 21st, 1897, the German ship "Arethusa" encountered a curious illumination of the sea after midnight, when in the Bay of Bengal, lat. 14.2 degrees N., long. 96.5 degrees E. As far as the eye could reach the surface of the water shone with myriads of lights, which the officers declared had the effect of searchlights in a hazy atmosphere. The ship's log says: "It was a splendid but also an uncomfortable sight." At 2 A. M. it began to rain, and the phenomenon suddenly disappeared. The wind was south-southeast and east-southeast, its force 4, and the weather cloudy.

A more recent case was reported by Captain Breyer, of the Dutch steamer "Valentijn." At midnight August 12th, 1910, this vessel was near the Natuna Islands, in the South China Sea. The course was magnetic south, the speed eight knots. Suddenly the easterly horizon became illuminated with a light which commenced to oscillate rapidly and regularly. The phenomenon soon passed into a rotation of flashes above the water. It looked like a horizontal wheel, turning rapidly, the spokes being the rays of light running over the water. The rotation was against the sun and very regular, one ray passing every half second. The bundles of rays diverged very little and were not curved. The center could not be discerned as an isolated point. Gradually the rays grew clearer and somewhat narrower, until the source of light appeared to be beneath the ship. The water around the ship seemed to be in rapid oscillating motion, and it was as bright as at full moon (the moon had set at 10 P. M.). This lasted about five minutes; then the rotation recommenced with the center on the opposite side of the ship. The rotating rays gradually decreased in brilliancy and breadth, and at 12:40 A. M. the phenomenon had quite disappeared in the northwest to west.

In this case the ordinary phosphorescence of the water was not observed. The sea was rather smooth and the air clear. The phenomenon was observed by the captain, first and second mates, and first engineer, and on all of them it made a somewhat uncomfortable impression.

Similar observations have occasionally been reported to the Meteorological Office at London by the captains and officers of British ships.

No complete explanation of the phenomenon can be given. It is well known that in many marine organisms the capacity to produce light is awakened by sudden movement. Thus disturbance by the blade of an oar produces luminescence in the seat—commonly called "phosphorescence," though phosphorus has nothing to do with it. Also the wind rippling the surface of the water evokes the same luminosity from myriads of minute protozoa and crustacea, and the crests of the ripples are marked with light. The luminous rays seen in the cases above described appear to have marked lines of disturbance in a sea abounding in organisms capable of phosphorescence; in other words, long and regular waves, having a systematic movement of rotation. Such waves, however, appear to be altogether anomalous.

The Highest Balloon Ascent and Other Achievements of the Weather Bureau

TUCKED away in a corner of the annual report of the Chief of the Weather Bureau for the past fiscal year is the casual statement that a sounding-balloon sent aloft at Huron, South Dakota, September 1st, 1910, by the aerological staff of the Mt. Weather Observatory, reached an altitude of 18.9 miles above sea-level. This fact is in no way exploited, and the reader is left to find out for himself that never before in the history of science has any human contrivance traveled so far away from Mother Earth. The previous "record," an even 18 miles, was attained by a balloon sent up at Uccle, Belgium, November 5th, 1908. The modest way in which this remarkable occurrence is announced may perhaps be explained by the well-known unreliability of the barometrically determined altitudes of all high balloon ascents; the figures in this case may indeed be inaccurate to the extent of several hundred feet. The interesting fact remains, however, that meteorology has pushed its probe a little farther upward; and the details of this newest achievement, as yet unpublished, will be awaited with interest.

The Weather Bureau has now carried out four campaigns with sounding-balloons, comprising in all ninety-one ascents. For the benefit of readers who are unfamiliar with the methods of the "new meteorology" it may be explained that a sounding-balloon is allowed to go free, bearing with it some very light self-registering meteorological instruments. The expansion of the gas at great altitudes (where the pressure of the air is extremely small) bursts the balloon, and the gentle landing of the instruments is insured by means of a parachute. This sometimes occurs as much as two hundred miles away from the place of ascent. A label attached to the apparatus offers a reward (in this country two dollars) for its safe return to headquarters; and in eighty-one of the ninety-one ascents just mentioned the instruments were recovered.

The exploration of the upper air that has been carried on all over the world during the last ten years has led to a number of well-defined ideas about the atmosphere above the highest cloud-level; all of which have been recorded from time to time in our columns. The noteworthy feature of the recent remarkably high ascents made by the Weather Bureau is that they are not altogether consonant with existing views. Thus it does not seem to be uniformly true in this country that the "upper inversion"—the lower limit of the region in which the air stops growing colder with ascent—is at a lower level over cyclones than over anticyclones. It is, however, slightly lower in winter than in summer, as found in European ascents. The lowest temperature registered in a Weather Bureau ascent was 92 degrees below zero Fahrenheit.

The official report under review records some other notable researches in the field of pure science. A good beginning has been made in a pyrheliometric survey of the region west of the Great Lakes and the Mississippi; i. e., the measurement of the intensity of solar radiation. This work is a response to the demands of biologists for accurate data of the amount of heat received by plants from sun and sky; as well as a contribution to the general physics of the atmosphere. The study of atmospheric polarization is being carried on in connection with these investigations.

Turning to the more practical work of the Bureau, it is interesting to learn that wireless weather reports from vessels at sea have at last begun to yield useful results. Thus the first definite news of

the severe West India hurricane of October, 1910, came in the shape of a wireless report from the United Fruit Company's steamship "Abangarez." This report, in conjunction with the information from land stations, enabled the forecasters to locate the center of the disturbance with a degree of accuracy that would have been impossible with the aid of land reports alone. Conversely, timely advices concerning the movements of the storm were sent to vessels by wireless.

Ten Thousand Dollars in Prizes for Inventions

OUR attention has been drawn to a prize competition conducted every five years in connection with international conferences of Red Cross societies. The subjects are selected by the Red Cross Society of Russia and approved by an international committee having charge of the administration of the prize fund. The International Bureau of Red Cross makes the awards.

The aggregate amount of the prizes is 18,000 rubles (approximately $9,000), divided into nine prizes, in accordance with the schedule appended hereto.

SUBJECTS FOR COMPETITION.

1. Organization of the methods of evacuation of the wounded on the battlefield, comprising as complete an economy as possible in litter bearers.
2. Portable (surgeons') washstands for war.
3. Methods of packing dressings at the aid stations and in the ambulances.
4. Wheeled stretchers.
5. Carriage of stretcher on mule-back.
6. Folding stretcher easily portable.
7. Transport of the wounded between war vessels, hospital ships, and the coast.
8. The best method of heating railroad cars by a system independent of steam from the locomotive.
9. The best model of a portable Roentgen apparatus, permitting utilization of X-rays on the battlefield and at first aid stations.

PRIZES.

One first prize of 6,000 rubles (approximately $3,000).

Two second prizes of 3,000 rubles (approximately $1,500) each.

Six third prizes of 1,000 rubles (approximately $500) each.

WHEN AND WHERE TO BE AWARDED.

Inventions entered in this competition are to be displayed at an exhibition to be held on the occasion of the Ninth International Red Cross Conference at Washington, D. C., May 7th-17th, 1912.

All persons intending to compete for these prizes must forward to the chairman of the Exhibition Committee, at the above address, on or before March 1st, 1912, a statement of such intention, giving the number of cubic feet which will be required for the exhibition of their inventions.

Articles entered in this competition must be received, carriage prepaid, at Washington, D. C., on or before April 15th, 1912.

Further information may be obtained by addressing the chairman of the Exhibition Committee, American Red Cross, 341 State, War and Navy Building, Washington, D. C.

The Current Supplement

IN the current issue of our SUPPLEMENT, No. 1880, Mr. Walter L. Beasley tells us of steps taken by our government in the industrial education of the Eskimo, by the establishment of reindeer stations.—The article by Sir Charles A. Parsons on the Marine Steam Turbine is brought to a conclusion.—An important article on the Automatic Telephone Exchange Systems, by W. Aitken, begins in this issue. The retiring vice-president of Section D of the A. A. A. S. selected as the subject of his address "Aerial Engineering." This is reproduced in full.—A very able account of the use of oxygen gas in the arts and industries is given by August S. Neumark.—The keynote of Prof. Smithwell's presidential address before the Society of British Gas Industry may be summed up in his words, "*The Essence of University Finance is Collective Investment.*"—Some interesting investigations on the adherence of flat surfaces, carried out by Mr. H. M. Budgett, are reported on.